

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter identifies and describes potential environmental consequences of the project alternatives (including the No Action Alternative), including both adverse and beneficial impacts. Generally, impacts are categorized as direct or indirect.

Direct Impacts. Impacts that occur as a direct, immediate, and local result of a project are termed direct impacts. Direct impacts are either permanent or temporary. Permanent impacts are direct, continuing impacts that result from the existence and operation of a project. Temporary impacts are direct impacts that result from project construction activities, and include effects such as disturbance of land and wildlife habitat, noise and air pollutants from operation of construction machinery and vehicles, traffic detours and congestion, degradation of the visual environment by large construction equipment, and the economic benefits of additional jobs in the construction sector.

The direct impacts of the Gravina Access Project are discussed in the first 25 sections of this Chapter 4 as follows:

- 4.1 Land Use Impacts
- 4.2 Farmland Impacts
- 4.3 Social Impacts
- 4.4 Relocation Impacts
- 4.5 Economic Impacts
- 4.6 Joint Development Impacts
- 4.7 Transportation Impacts
- 4.8 Considerations Relating to Pedestrians and Bicyclists
- 4.9 Impacts on Geology, Topography, and Soils
- 4.10 Air Quality Impacts
- 4.11 Noise Impacts
- 4.12 Water Quality Impacts
- 4.13 Permits
- 4.14 Wetland and Vegetation Impacts
- 4.15 Waterbodies and Wildlife Impacts
- 4.16 Floodplain Impacts
- 4.17 Wild and Scenic River Impacts
- 4.18 Coastal Barriers
- 4.19 Coastal Zone Impacts
- 4.20 Threatened and Endangered Species
- 4.21 Historical and Archeological Preservation
- 4.22 Hazardous Waste Sites
- 4.23 Visual Impacts
- 4.24 Energy
- 4.25 Construction Impacts

Indirect or Secondary Impacts. Secondary impacts are impacts related to the project that are reasonably foreseeable; yet (compared to direct impacts) occur later in time and farther in distance (40 CFR 1508.8). For instance, the construction of a road in an undeveloped area could have direct adverse impacts (such as removing wildlife habitat, disrupting bird nesting behavior, and forcing businesses to relocate) and direct benefits (such as providing access to

developable land). But any effects of the project that occur indirectly (such as land development that is induced because it now has roadway access) would be secondary impacts. The secondary impacts of the project alternatives are discussed in Section 4.26.

Cumulative Impacts. The cumulative effects of a project are those that “result from the incremental consequences of an action when added to other past and reasonably foreseeable future actions” (40 CFR 1508.7). Such future actions are those projects that are far enough along in the planning process that their implementation is reasonably foreseeable. The cumulative impacts of the project alternatives are discussed in Section 4.27.

Short-term Uses and Long-term Productivity. The natural productivity of land is considered a long-term, renewable use of the land, whereas land development generally is short-term and has a relatively short economic life. The short-term uses and long-term productivity of the project are described in Section 4.28.

Irreversible and Irretrievable Commitment of Resources. Implementing any of the project build alternatives would use a range of natural, physical, human, and fiscal resources, some of which would be irreversible and irretrievable. The commitment of such resources by the project is discussed in Section 4.29.

4.1 LAND USE IMPACTS

Section 4.1 discusses the project’s direct impacts on land use: Section 4.1.1 examines the impacts of the project on land use, based on current development trends and patterns and zoning, and Section 4.1.2 assesses the consistency of project alternatives with relevant land use plans.

4.1.1 Direct Impacts on Land Use

The alignment of the build alternatives on Gravina Island has been coordinated with available information from the *Ketchikan International Airport Master Plan* to avoid adverse impacts to land use within the airport property. See Section 4.4 (Relocation Impacts), Section 4.7 (Transportation Impacts), Section 4.14 (Wetland and Vegetation Impacts), and Appendix C (*Conceptual Stage Relocation Study and Assessment of Right-of-Way Acquisition Costs*) for more information.

4.1.1.1 No Action Alternative

No land would be developed or directly affected as a result of the No Action Alternative. Land use patterns would not change. This has adverse impacts for the city and borough of Ketchikan, although they are principally secondary impacts (see Section 4.26.1). No direct access to airport and borough lands would take place.

4.1.1.2 Alternative C3(a)

Alternative C3(a) would require acquisition of right-of-way from individual commercial and residential properties, converting portions of these properties to transportation use. The affected commercial properties contain a bank and an auto dealership at the intersection of Tongass Avenue and Signal Road. Some of the parking area for the bank and the car dealership would be reduced as a result of this alternative; however, the bank and car

dealership would continue to function and overall land use of these properties would not change. Along the hillside parallel to Tongass Avenue, the construction right-of-way would require acquisition of portions of residential properties along Baker Street North and Bucey Avenue North. The conversion of these areas to transportation use would not affect the continued use of the remaining portions of the properties for residential use. One residential property would likely be converted entirely to transportation use for the Alternative C3(a) alignment. This would not affect the overall supply of residential land in Ketchikan.

4.1.1.3 Alternative C3(b)

The alignment of Alternative C3(b) would follow the same general alignment as Alternative C3(a), except where it crosses Tongass Avenue. Like Alternative C3(a), Alternative C3(b) would require acquisition of right-of-way within commercial and residential properties, converting portions of these properties to transportation use. The affected commercial properties contain a bank and an auto dealership at the intersection of Tongass Avenue and Signal Road. Some of the parking area for the bank and the car dealership would be reduced as a result of this alternative; however, the bank and car dealership would continue to function and overall land use of these properties would not change.

The different configuration of the Alternative C3(b) alignment in its approach to the bridge crossing would require more right-of-way than Alternative C3(a) within the residential area of Baker Street North and Bucey Avenue North along the hillside parallel to Tongass Avenue. For most of these properties, the conversion of portions of the properties to transportation use would not affect the continued use of the remaining portions of the properties for residential use. Two residential properties would likely be converted entirely to transportation use for the Alternative C3(b) alignment. This would not affect the overall supply of residential land in Ketchikan.

4.1.1.4 Alternative C4

Alternative C4 would intersect Tongass Avenue north of Cambria Drive and south of the Carlanna Construction Quarry. The intersection of Alternative C4 and Tongass Avenue would be directly north of a residential property on Tongass Avenue.

The right-of-way would also cross through the approximate center of the Ketchikan Ready-Mix and Quarry property and through the Dawson Construction property. This location of the alignment would disrupt Ketchikan Ready-Mix and Quarry operations and may require the acquisition of portions of the Dawson Construction facilities. Other hard rock quarry resources are available in Ketchikan and the change to transportation uses would not affect the supply of quarry rock in the region. There are also two buildings under construction (a construction office and 3-bay large equipment garage) that may have to be relocated to construct Alternative C4.

4.1.1.5 Alternative D1

Alternative D1 would intersect Tongass Avenue at Cambria Drive, south of the Carlanna Construction Quarry. Acquisition of a small amount of land on the south side of Cambria Drive may be required. The right-of-way would traverse the hillside parallel to Tongass Avenue, north of the Cambria neighborhood, for approximately 0.3 mile, crossing through the Dawson Construction Company property and west of the Carlanna Construction quarry operations. This location of the alignment would disrupt Dawson Construction Company operations and may require acquisition of portions of their facilities. There are also two buildings under construction

(a construction office and 3-bay large equipment garage) that may have to be relocated to construct Alternative D1.

4.1.1.6 Alternative F1 (Preferred)

On Revillagigedo Island, Alternative F1 would connect with Tongass Avenue south of Tatsuda's grocery store in the vicinity of the existing rock quarry. The road would gain elevation, heading up the hill in a southeasterly direction, staying east of the tank farm, the cemetery, and the USCG Station. A portion of the USCG Station (an institutional land use) would be converted to a transportation use, but this would not affect the mission or activities at the USCG Station. The road would turn to the west, skirting the south end of the U.S. Coast Guard Base property, north of the Forest Park Subdivision and cross the east channel of Tongass Narrows to Pennock Island. On Pennock Island, Alternative F1 would require the use of undeveloped, Borough owned property, which is zoned for residential use. On Gravina Island, the alignment would traverse undeveloped property until reaching the airport property. Approximately ½ mile of the road would traverse undeveloped, private, residentially zoned property. The remaining undeveloped property along the alignment is owned by the Borough or State and zoned for future development, commercial, or airport related uses. The conversion of undeveloped property to transportation use would not cause any adverse effect to the overall supply of undeveloped land.

4.1.1.7 Alternative F3

On Revillagigedo Island, Alternative F3 would intersect Tongass Avenue south of the U.S. Coast Guard station in an area that is presently undeveloped. On Pennock Island, the bridge would traverse undeveloped Borough land south of Whiskey Cove and would remain on vacant Borough land across Pennock Island. The road would pass a residential lot on the Pennock Island waterfront of the West Channel and make landfall on Gravina Island south of a Clam Cove. On Gravina Island, the alignment would traverse undeveloped property until reaching the airport property. Approximately ½ mile of the road would traverse undeveloped, private, residentially zoned property. The remaining undeveloped property along the alignment is owned by the Borough or State and zoned for future development, commercial, or airport related uses. The conversion of undeveloped property to transportation use would not cause any adverse effect to the overall supply of undeveloped land.

4.1.1.8 Alternative G2

Alternative G2 would require the conversion of a commercial property on Peninsula Point, which is now used as a floatplane maintenance hangar, to transportation use for construction of a ferry terminal and associated parking facilities. Access to the ferry terminal from Tongass Highway would require acquisition of right-of-way from commercial properties adjacent to the highway, but the properties would continue to function as commercial sites.

4.1.1.9 Alternative G3

Alternative G3 would require the construction of a ferry terminal in downtown Ketchikan, just south of the Ketchikan boat harbor. This alternative would involve construction of a ferry terminal and parking facilities at the current location of three commercial buildings—a gas station, a fast-food restaurant (Burger King), and the Gateway City Realty building. The Gateway City Realty building has three tenants (businesses) that would be displaced. In

addition, a portion of the Plaza Mall parking lot would have to be acquired to build the ferry terminal. Reduction of parking availability would affect the commercial use of the mall. The mall, however, would retain a sufficient amount of parking to be viable.

4.1.1.10 Alternative G4

Alternative G4 would require the construction of a new ferry terminal adjacent to the existing ferry terminal. No change in land use would occur.

4.1.1.11 Assistance for Property Impacts

Fair market value and relocation assistance would be provided to property owners affected by Alternatives C3(a), C3(b), C4, D1, G2, and G3. See also Section 4.4 (Relocation Impacts).

4.1.2 Consistency with Land Use Plans and Policies

The plans of local jurisdictions with authority to govern land use decisions are the *Pennock and Gravina Island Neighborhood Plan*, 1985; the *Coastal Management Program*, 1984 (Amended 1989); the *Ketchikan Gateway Borough Comprehensive Plan*, 1996¹; and the *Ketchikan International Airport Master Plan* (in progress).

4.1.2.1 No Action Alternative

The No Action Alternative would be inconsistent with the *Pennock and Gravina Island Neighborhood Plan*, the *Coastal Management Program*, and the *Ketchikan Gateway Borough Comprehensive Plan*. The *Pennock and Gravina Island Neighborhood Plan* envisions some kind of ferry access for Pennock Island over the long term. The No Action Alternative would not provide ferry access to Pennock Island and would therefore do nothing to foster the implementation of the plan. Both the *Coastal Management Program* and the *Ketchikan Gateway Borough Comprehensive Plan* discuss the need for improved access to Gravina Island and identify a hard link (bridge) as the solution supported by the plans. The No Action Alternative would provide no improvement consistent with the intent of either of these plans.

The *Ketchikan International Airport Master Plan* explores both ferry and bridge access to the airport. Ferry access as described by the No Action Alternative would be consistent with the plan.

Overall development in the Borough would continue under the No Action Alternative, corresponding to the growth in population. On Pennock Island, a few residential lots could be developed. Gravina Island, without improved access, would experience only a small portion of the region's future development. On Revillagigedo Island, the fastest-growing residential areas would be near Point Higgins (about 15 miles north of downtown Ketchikan); future residential development is anticipated to occur increasingly farther from downtown Ketchikan because of the lack of developable land in the city.

¹ Ketchikan Gateway Borough Planning Department, *Neighborhood Plan*; *Coastal Management Plan*; and *Comprehensive Plan*.

4.1.2.2 Alternatives C3(a), C3(b), C4, and D1

These four bridge alternatives are consistent or have not been identified as conflicting with the *Pennock and Gravina Island Neighborhood Plan*, the *Coastal Management Program*, the *Ketchikan Gateway Borough Comprehensive Plan*, and the *Ketchikan International Airport Master Plan*.

The *Pennock and Gravina Island Neighborhood Plan* clearly articulates that residents were (in 1985) concerned about the changes to the island that a bridge could bring. The plan also envisions some kind of ferry access for Pennock Island over the long term. Alternatives C3(a), C3(b), C4, and D1 would not provide ferry access to Pennock Island and would therefore do nothing to foster the implementation of the plan.

The *Coastal Management Program* identifies a need for additional commercial and industrial waterfront property and specifies a hard link to Gravina Island as a solution. As such, these bridge alternatives would be consistent with the plan. These alternatives also would further the implementation of the key economic development and land supply strategy articulated in the *Coastal Management Program*. As quoted from the *Coastal Management Program*, the benefits of a hard link would be:

- ◆ Airport Development
- ◆ Access to commercial and industrial waterfront property
- ◆ Access to borough land selections
- ◆ Access to developable land close to the city center
- ◆ Mutual aid opportunities for fire and police services
- ◆ Improved airfreight service to the business community.

The *Ketchikan Gateway Borough Comprehensive Plan* envisions a hard link as the mode of future access to the Gravina Island and under the “Transportation Element” identifies a bridge as the number 1 strategy for “ensuring adequate access.” As such, these bridge alternatives would be consistent with the plan. These alternatives also would further the implementation of the key economic development and land supply strategy articulated in the *Ketchikan Gateway Borough Comprehensive Plan*. The plan cites access to additional developable lands on Gravina Island as an economic development strategy of the Borough. The plan further states that the goal of economic development is to “expand and diversify the local economy,” and that the primary mechanism for achieving this goal is “Gravina Island development.”²

The forecasting chapter of the *Ketchikan International Airport Master Plan* examines bridge access and anticipates it as a possible future mode of access and identifies a location for a parking garage, should bridge access come to fruition. If properly planned and designed to minimize and mitigate adverse impacts on the airport, bridge access would be consistent with the plan.

4.1.2.3 Alternatives F1 (Preferred) and F3

Alternatives F1 and F3 are consistent with the *Coastal Management Program*, the *Ketchikan Gateway Borough Comprehensive Plan*, and the *Ketchikan International Airport Master Plan*, but inconsistent with the *Pennock and Gravina Island Neighborhood Plan*.

² DOT&PF, *Airport Master Plan*.

Improved access to Gravina Island is consistent with the *Coastal Management Plan*, as noted in Section 3.1.2.2. However, the plan provides little policy guidance regarding access to Pennock Island or to Gravina Island via Pennock Island. As presented in Chapter 4 of the *Ketchikan Gateway Borough Comprehensive Plan*, the Borough anticipates a shortage of commercial and industrial land and envisions using Borough holdings on Gravina and Pennock Islands to satisfy the demand. The plan indicates that “expanding the community’s land base to any extent, however, is dependent on providing roaded access to it, in this case, a hard link.” From this discussion, hard-link access via Pennock Island would not be inconsistent with the *Ketchikan Gateway Borough Comprehensive Plan*. Under the “Transportation Element” the plan identifies a bridge as the number 1 strategy for “ensuring adequate access.” The plan, however, does not support accessing Pennock Island lands as clearly as it does Gravina Island lands.

Bridge access is examined and anticipated as a possible future mode of access in the forecasting chapter of the *Ketchikan International Airport Master Plan*. Bridge access, if properly planned and designed to minimize and mitigate the secondary impacts associated with additional car parking and circulation, would be consistent with the plan.

The *Pennock and Gravina Island Neighborhood Plan* clearly articulates a vision for future transportation access that could include a ferry to Pennock Island. Regarding a bridge, the plan states: “Hard access by bridge or tunnel from Pennock to Gravina Island is not envisioned in the foreseeable future and, in light of the rural characteristics should not be pursued. Hard access and its possible location is of concern to the community as a whole and should be determined by a borough-wide vote” (p. 26).

A Borough-wide proposition in October 2002 asked voters if the Borough should be prohibited from using Borough lands for the Gravina Access Project. The proposition failed by nearly a two to one margin, indicating that a majority of those who voted support the use of Borough-owned lands for improving access to Gravina Island.

Many of the actions and strategies articulated in the Pennock Island component of the *Pennock and Gravina Island Neighborhood Plan* have never been implemented. The plan may need to be updated and amended if Alternative F1 or F3 were selected. That planning process could potentially specify mitigation to minimize the land use impacts of a crossing on Pennock Island. Connecting to a new road system would require DOT&PF approval. DOT&PF would control the number of connecting local driveways and roads to the bridge access road across the island based on DOT&PF policy and community input.

4.1.2.4 Alternatives G2, G3, and G4

Improved access to Gravina Island by means of increased ferry service is consistent with the *Ketchikan International Airport Master Plan*, which anticipates that the ferry would continue to be the future mode of transport to the airport. The ferry alternatives are also consistent with the *Ketchikan Gateway Borough Comprehensive Plan*. The number 2 strategy of the plan for “ensuring adequate access” to Gravina Island is “enhancing ferry access.” As such, Alternatives G2, G3, and G4 are consistent with the plan, but the plan articulates a stronger preference for bridge access.

Improving ferry access to Gravina Island with Alternatives G2, G3, and G4 would not implement ferry access to Pennock Island, which was articulated as a long-term planning goal of the

Pennock and Gravina Island Neighborhood Plan; therefore, the ferry alternatives do not advance the goals and objectives of the plan. The G Alternatives would not have an adverse impact on the Coastal Management Program vision, as stated.

4.2 FARMLAND IMPACTS

The No Action Alternative and Alternatives C3(a), C3(b), C4, D1, F1, F3, G2, G3, and G4 would have no impact on farmland because there is no farmland in the project area that is considered prime or unique, or is of statewide or local importance.

4.3 SOCIAL IMPACTS

4.3.1 Population and Social Groups

4.3.1.1 Ketchikan Gateway Borough

None of the alternatives (No Action Alternative, Alternatives C3[a], C3[b], C4, D1, F1, F3, G2, G3, and G4) would impact the population or social groups of the Borough.

4.3.1.2 Minority and Low-Income Populations

There are no predominantly minority or low-income populations in the study area. Therefore, none of the Gravina Access Project alternatives would have an adverse environmental justice effect.

4.3.2 Neighborhoods and Community Cohesion

4.3.2.1 No Action Alternative

The No Action Alternative would not change existing neighborhoods and community character.

4.3.2.2 Alternatives C3(a) and C3(b)

The Baker Street North/Bucey Avenue North neighborhood along the hillside between Signal Road and the Alternative C3(a) and C3(b) bridges would be adversely affected by the proximity of traffic on the new alignment, which would diminish the sense of quiet and the suburban atmosphere. The alignments associated with these alternatives traverse the edge of the neighborhood and would not affect the cohesion of the neighborhood (see Section 4.4 Relocation Impacts for more information). Direct access to the new facility would be limited and current neighborhood streets would not be used for cut-through access.

The alignments of these alternatives are not within or adjacent to neighborhoods on Gravina Island. Although the hard-link connection would provide a greater sense of connection to Ketchikan for Gravina Island neighborhoods, the communities would maintain their remote character. This remote character would be altered if secondary development created a physical connection to these neighborhoods (see Section 4.26.2.2).

4.3.2.3 Alternatives C4 and D1

The Cambria Drive neighborhood would be adversely affected by the proximity of traffic on the new alignment, which would diminish the sense of quiet and the suburban atmosphere. The alignments associated with these alternatives traverse the edge of the neighborhood and would not affect the cohesion of the neighborhood (see Section 4.4 Relocation Impacts for more information). Direct access to the new facility would be limited and current neighborhood streets would not be used for cut-through access.

The alignments of these alternatives are not within or adjacent to neighborhoods on Gravina Island. Although the hard-link connection would provide a greater sense of connection to Ketchikan for Gravina Island neighborhoods, the communities would maintain their remote character. This remote character would be altered if secondary development created a physical connection to these neighborhoods (see Section 4.26.2.2).

4.3.2.4 Alternative F1 (Preferred)

This alternative would not bisect neighborhoods or adversely affect the cohesion of neighborhoods; however, noise and traffic levels associated with the alignment could diminish the sense of quiet and the suburban atmosphere on the north side of the Forest Park neighborhood (see Section 4.4 Relocation Impacts for more information). Direct access to the new facility would be limited and current neighborhood streets would not be used for cut-through access.

Some could view the hard link between Revillagigedo Island, Pennock Island, and Gravina Island as a positive impact because it could improve the cohesion of the community by linking neighborhoods (existing and future) on all sides of Tongass Narrows. On the other hand, residents of Gravina and Pennock Islands who value the separation and remote aspects of life on those islands could be adversely impacted by the physical connection between the communities.

4.3.2.5 Alternative F3

This alternative would not bisect neighborhoods or adversely affect the cohesion of neighborhoods (see Section 4.4 Relocation Impacts for more information). Direct access to the new facility would be limited and current neighborhood streets would not be used for cut-through access.

Some could view the hard link between Revillagigedo Island, Pennock Island, and Gravina Island as a positive impact because it could improve the cohesion of the community by linking neighborhoods (existing and future) on all sides of Tongass Narrows. On the other hand, residents of Gravina and Pennock Islands who value the separation and remote aspects of life on those islands could be adversely impacted by the physical connection between the communities.

4.3.2.6 Alternatives G2, G3, and G4

No residential areas would be directly affected by these alternatives. The alignment does not bisect any neighborhoods and would not adversely affect the cohesion of neighborhoods (see Section 4.4 Relocation Impacts for more information). The limited access provided by the ferry

alternatives would not significantly change the separation and remote lifestyle of Gravina Island residents offered by the physical divide of Tongass Narrows.

4.3.3 Community and Public Service Facilities

4.3.3.1 No Action Alternative

Under the No Action Alternative, the problems and inconvenience identified and associated with the current ferry access between public facilities and developed land on Revillagigedo Island (police, fire stations, hospital) and Ketchikan International Airport would continue.

4.3.3.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), and F3

There would be no direct impact on existing or planned community facilities and public services with the bridge alternatives. Accessibility to public services such as fire, police, and hospitals would improve considerably with the 24-hour access provided by a bridge. It would be easier for residents of Gravina Island to travel to Revillagigedo Island for necessary medical services, and it would be easier for emergency personnel to travel to Gravina Island.

4.3.3.3 Alternatives G2, G3, and G4

There would be no direct impact on community facilities and public services with the ferry alternatives. Accessibility to public services such as fire, police, and hospitals would improve with the additional ferry service. It would be easier for residents of Gravina Island to travel to Revillagigedo Island for necessary medical services, and it would be easier for emergency personnel to travel to Gravina Island with an additional ferry, but access (as with the existing ferry) would still be unavailable during non-operating hours or severe weather.

4.3.4 Recreation

4.3.4.1 No Action Alternative

With the No Action Alternative, access to recreational land on Gravina Island would not improve and those opportunities would remain difficult and inconvenient for Ketchikan residents and visitors to access. These issues are described in detail in Chapter 2 (Purpose and Need).

4.3.4.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

A direct benefit of improved access to Gravina Island associated with all build alternatives would be better accessibility to recreational areas, parks, and facilities. There are numerous recreational opportunities on Gravina Island and improved access would make those opportunities more accessible to Ketchikan residents and visitors. The improved access to recreational opportunities would likely have adverse secondary impacts by increasing demand for recreation and public services, such as fire and police protection. These secondary impacts are described in Section 4.26 (Secondary Impacts).

4.3.5 Accessibility

4.3.5.1 No Action Alternative

There would be no change in travel patterns and accessibility. Travel to the airport would continue on the existing ferry, other trips would continue to be made with private boats. Accessibility problems, as identified in Chapter 2 (Purpose and Need), would continue.

The No Action Alternative would have no traffic safety effects. Overall public safety for residents and development on Gravina Island would continue to be adversely affected by poor accessibility to medical services and fire protection. Residents would continue to make trips to and from Ketchikan in private skiffs across Tongass Narrows. Tongass Narrows is a narrow waterway with heavy boat and seaplane traffic.

4.3.5.2 Alternative C3(a) and Alternative C3(b)

Alternatives C3(a) and C3(b) would improve accessibility between Revillagigedo and Gravina Islands. The alternatives are located near Signal Road and would improve accessibility to the airport and developable lands on Gravina Island by providing 24-hour access. Development potential would increase due to more convenient access to Gravina Island. Vehicular travel patterns would change slightly because the location of these alternatives on Revillagigedo Island is near Signal Road (north of the existing airport ferry). Accessibility for pedestrians and bicyclists would be improved as a result of 24 hours-per-day availability of access; however, the travel route would be longer for pedestrians and bicyclists originating from, or destined to, areas on Revillagigedo Island south of the existing airport ferry terminal, and require more physical exertion to overcome grade changes (particularly with Alternative C3[a]). Effects on travel time are described in Sections 4.7.3 (vehicles) and 4.8 (pedestrians and bicyclists).

These alternatives would add an additional intersection on Tongass Avenue. This would increase traffic conflicts and affect traffic safety. The improved access and additional lane miles would increase vehicle miles traveled. Driving an automobile can be dangerous and to the extent that vehicle miles traveled would increase, traffic accidents would also increase. However, the intersections of the alignment with Tongass Avenue would be signalized and designed to American Association of State Highway Transportation Officials (AASHTO) standards, minimizing the impact on traffic safety.

Overall public safety would increase by improving accessibility between medical services and Ketchikan International Airport for medical evacuations and through an opportunity for sharing firefighting equipment and personnel between airport and community emergency services.

4.3.5.3 Alternative C4 and Alternative D1

Alternatives C4 and D1 would improve accessibility between Revillagigedo and Gravina Islands. The alternatives are located near the airport and would improve accessibility to the airport and developable lands on Gravina Island by providing 24-hour access. Development potential would increase due to more convenient access to Gravina Island. Vehicular travel patterns would not change because the location of these alternatives on Revillagigedo Island is near the existing airport ferry. Accessibility for pedestrians and bicyclists would be improved as a result of 24 hours-per-day availability of access; however, as compared with existing conditions, the

new travel corridor would be longer for many pedestrians and bicyclists, and require more physical exertion to overcome grade changes (particularly with Alternative C4). Effects on travel time are described in Sections 4.7.3 (vehicles) and 4.8 (pedestrians and bicyclists).

These alternatives would add an additional intersection on Tongass Avenue. This would increase traffic conflicts and affect traffic safety. The improved access and additional lane miles would increase vehicle miles traveled. Driving an automobile can be dangerous and to the extent that vehicle miles traveled would increase, traffic accidents would also increase. However, the intersections of the alignment with Tongass Avenue would be signalized and designed to AASHTO standards, minimizing the impact on traffic safety.

Overall public safety would increase by improving accessibility between medical services and Ketchikan International Airport for medical evacuations and through an opportunity for sharing firefighting equipment and personnel between airport and community emergency services.

4.3.5.4 Alternatives F1 (Preferred) and F3

Alternatives F1 and F3 would improve accessibility between Revillagigedo and Gravina Islands. The alternatives are located south of town and would improve accessibility to the airport and developable lands on Gravina Island by providing 24-hour access. Development potential would increase due to more convenient access to Gravina Island. Vehicular travel patterns would change because the location of these alternatives on Revillagigedo Island is south of town. Accessibility for pedestrians and bicyclists would be improved as a result of 24 hours-per-day availability of access; however, as compared with existing conditions, the new travel corridor would be longer for many pedestrians and bicyclists, and require more physical exertion to overcome grade changes. Effects on travel time are described in Sections 4.7.3 (vehicles) and 4.8 (pedestrians and bicyclists).

Alternatives F1 and F3 also touch down on Pennock Island. Road access from the Alternative F1 and F3 alignments to Pennock Island neighborhoods is not included in these alternatives. However, the Borough Assembly has indicated that, with the selection of Alternative F1 as the preferred alternative, it will request the Borough Planning Department to update the Pennock Island Plan to include a framework for local transportation access and infrastructure. Alternatives F1 and F3 provide an opportunity to connect these Pennock Island neighborhoods to Gravina and Revillagigedo Islands in the future.

These alternatives would add an additional intersection on Tongass Avenue. This would increase traffic conflicts and affect traffic safety. The improved access and additional lane miles would increase vehicle miles traveled. Driving an automobile can be dangerous and to the extent that vehicle miles traveled would increase, traffic accidents would also increase. However, the intersections of the alignment with Tongass Avenue would be signalized and designed to AASHTO standards, minimizing the impact on traffic safety.

Overall public safety would increase by improving accessibility between medical services and Ketchikan International Airport for medical evacuations and through an opportunity for sharing firefighting equipment and personnel between airport and community emergency services.

4.3.5.5 Alternatives G2, G3, and G4

Alternatives G2, G3, and G4 would improve accessibility between Revillagigedo and Gravina Islands. The alternatives would improve accessibility to the airport and developable lands on Gravina Island by providing another option for ferry access—G2 is located north of the existing ferry, G3 is located south of the existing ferry, and G2 is located right near the existing ferry. Development potential would increase due to more convenient access to Gravina Island. Vehicular travel patterns would change for alternatives G2 and G3 because of the location of these alternatives on Revillagigedo Island (north or south of the existing airport ferry). Accessibility for pedestrians and bicyclists would be improved as a result of having two location options for crossing Tongass Narrows. Effects on travel time are described in Sections 4.7.3 (vehicles) and 4.8 (pedestrians and bicyclists).

Overall public safety for residents on Gravina Island would improve as compared to the No Action Alternative as a result of the additional ferry connection to Revillagigedo Island. However, residents would continue to be adversely affected by the accessibility to medical services and fire protection as dictated by ferry scheduling. Safety would not improve over existing conditions during the hours in which the ferries would not be operating. Residents would continue to make trips to and from Ketchikan in private skiffs across Tongass Narrows after the operating hours of the ferry.

4.3.6 Subsistence

4.3.6.1 No Action Alternative

The No Action Alternative would have no impact on subsistence.

4.3.6.2 Alternatives C3(a), C3(b), C4, D1, , G2, G3, and G4

The only direct impact on subsistence would be the loss of habitat that might support subsistence activity (see Table 4-11 in Section 4.14). Alternative C3(a) would impact 44.1 acres of wetlands, 0.1 acres of ponds, and 5.1 acres of uplands. Alternative C3(b) would impact 42.4 acres of wetlands, 0.1 acres of ponds, and 9.1 acres of uplands. Alternative C4 would impact 39.0 acres of wetlands, 0.1 acres of ponds, and 10.4 acres of uplands. Alternative D1 would impact 36.3 acres of wetlands, 0.1 acres of ponds, and 8.6 acres of uplands. Alternative G2 would impact 42.5 acres of wetlands, 0.1 acres of ponds, and 7.6 acres of uplands. Alternative G3 would impact 47.5 acres of wetlands, 0.1 acres of ponds, and 7.0 acres of uplands. Alternative G4 would impact 35.4 acres of wetlands, 0.1 acres of ponds, and 4.7 acres of uplands.

4.3.6.3 Alternatives F1 (Preferred) and F3

One direct impact on subsistence would be the loss of habitat that might support subsistence activity (see Table 4-11 in Section 4.14). Alternative F1 would impact 103.3 acres of wetlands, 0.1 acres of ponds, and 10.7 acres of uplands. Alternative F3 would impact 85.2 acres of wetlands, 0.1 acres of ponds, and 4.8 acres of uplands. Improved access to Pennock Island with these alternatives would result increased subsistence use on Pennock Island.

In contrast to the direct loss of habitat from all build alternatives, the total area of Gravina Island is 61,404 acres. Seventy percent of the island (approximately 43,000 acres) is wetland.

Approximately 3,276 acres of the wetlands, including estuaries, tall sedge fens, scrub-shrub alder/willow, and moss muskeg/sphagnum peat muskegs, were identified by the USDA Forest Service as "high-value wetlands" because of their fish and wildlife habitat value, a relative rarity. Productive old growth forest, particularly at low elevations, is important for deer. There are 11,123 acres of productive old growth below 800 feet elevation on National Forest lands of Gravina Island, and another 7,800 acres above that elevation. Additional deer habitat exists on non-Forest lands³.

Secondary impacts on subsistence are addressed in Section 4.26.

4.3.7 Utilities

4.3.7.1 Water

No Action Alternative

The No Action Alternative would not involve construction or additional utility usage, therefore, it would have no effect on the water utilities in the project area.

Alternatives C3(a) and C3(b)

In the Signal Road area, potable water systems consist of roof catchment systems or hauled water and there is no water distribution system; therefore, no impact on the existing water system would occur. On Gravina Island, the water supply main to Ketchikan International Airport would also not be affected by either of these alternatives.

Alternatives C4 and D1

In the Cambria Drive area, the potable water system consists of a buried 8-inch water line. It is highly unlikely that there would be any direct impact on this existing water line. However, depending on the final alignment of the bridge approach, there is a remote possibility that other buried facilities associated with the bridge approach, such as conduits for the lighting and signaling systems, would interfere with the water line. Relocation of up to 100 feet of water line in the Cambria Drive area might be required (the estimated cost of relocating 100 feet of water line is \$10,000).

On Gravina Island, the water supply main to Ketchikan International Airport would also not be affected by either of these alternatives.

Alternative F1 (Preferred)

A buried water supply main parallels South Tongass Avenue on Revillagigedo Island, extending as far south as the USCG Station. This water supply main could be within the construction area of Alternative F1 and may need to be relocated. Relocation of up to 100 feet of water line on South Tongass Avenue might be required (the estimated cost of relocating 100 feet of water line is \$10,000). Potable water supplies for residences on Pennock and Gravina Islands consist of

³ USDA Forest Service. January 2001. Gravina Island Timber Sale Draft Environmental Impact Statement.

roof catchment systems or hauled water and would not be affected by Alternative F1. Alternative F1 would not affect the water supply main to the airport. No other water distribution systems exist in the vicinity of this alternative, so there is no expected impact on existing facilities.

Alternative F3

Potable water supplies in the vicinity of Alternative F3 on Revillagigedo Island and for residences on Pennock and Gravina Islands consist of roof catchment systems or hauled water. Alternative F3 would not affect the water supply main to the airport. No other water distribution systems exist in the vicinity of this alternative, so there is no expected impact on existing facilities.

Alternatives G2, G3, and G4

At the Revillagigedo Island landings of each of the proposed ferry routes, all project improvements would be seaward of any water lines, so there is no expected impact. Nor would any water lines on Gravina Island be affected by any of these alternatives.

4.3.7.2 Sewer

No Action Alternative

The No Action Alternative would not involve construction or additional utility usage, therefore, it would have no effect on the sewer utilities in the project area.

Alternatives C3(a) and C3(b)

In the Signal Road area, sewage disposal typically consists of on-site disposal systems, and there is no sewage collection system; therefore, no impact on the existing sewer system would occur. On Gravina Island, the wastewater treatment facilities at the airport would also not be affected by these alternatives.

Alternatives C4 and D1

In the Cambria Drive area, the sewage collection system consists of a buried 8-inch line. It is highly unlikely that there would be any direct impact on this existing sewer line. However, depending on the final alignment of the bridge approach, there is a remote possibility that other buried facilities associated with the bridge approach, such as conduits for the lighting and signaling system, would interfere with the sewer line. Relocation of up to 100 feet of sewer line in the Cambria Drive area might be required (the estimated cost of relocating 100 feet of sewer lines is \$10,000).

On Gravina Island, the wastewater treatment facilities at the airport would not be affected by either of these alternatives.

Alternatives F1 (Preferred) and F3

Sewage disposal in the project area of Revillagigedo Island and for residences on Pennock and Gravina Islands typically consists of on-site disposal systems. The wastewater treatment

facilities at the airport would not be affected by either of these alternatives. No other sewage collection systems exist in the vicinity of these alternatives, so there is no expected impact on other existing sewer facilities.

Alternatives G2, G3, and G4

At the Revillagigedo Island landings of each of the proposed ferry routes, all project improvements would be seaward of any sewer lines, so there is no expected impact. Nor would any sewer lines on Gravina Island be affected by any of these alternatives.

4.3.7.3 Electricity and Telephone

The electrical and telephone lines on Revillagigedo Island are in most instances co-located and, therefore, are discussed together in this impact analysis.

No Action Alternative

The No Action Alternative would not involve construction or additional utility usage, therefore, it would have no effect on the electrical and telephone utilities in the project area.

Alternatives C3(a) and C3(b)

Along Tongass Avenue, the main electrical and telephone lines are located overhead on poles, but the bridge overpass is expected to be high enough to clear them. On Gravina Island, electric and telephone service to the airport would not be affected by either of these alternatives.

In the Signal Road area, electric and telephone lines are overhead on poles. Depending on the final alignment of the bridge approach, the project might interfere with the power poles or lines on Signal Road. Relocation of up to two power poles and associated lines in the Signal Road area might be required (the estimated cost of relocating two poles and associated electric and telephone lines is \$40,000).

Alternatives C4 and D1

On Tongass Avenue, the main electrical and telephone lines are located on overhead poles, but the bridge overpass is expected to be high enough to clear these power poles and lines. On Gravina Island, electric and telephone service to the airport would not be affected by either of these alternatives.

In the Cambria Drive area, electric and telephone lines are in underground conduits. It is highly unlikely that there would be any direct impact on these existing underground electrical and telephone lines. However, depending on the final alignment of the bridge approach, there is a remote possibility that other buried facilities associated with the bridge approach, such as conduits for lighting and signaling systems, would interfere with the existing buried electrical and telephone conduits. Relocation of up to 100 feet of buried electrical and telephone conduit might be required (the estimated cost of relocating 100 feet of buried conduit is \$10,000).

4.3.7.4 Alternatives F1 (Preferred) and F3

On Gravina Island, electric and telephone service to the airport would not be affected by either of these alternatives. On Tongass Avenue, the main electrical and telephone lines are located overhead on poles. The Alternative F1 bridge overpass of Tongass Avenue is expected to be high enough to clear these power poles and lines. Similarly, Alternative F3 would not require any changes to these poles and lines.

On Pennock Island, electric and telephone service is provided by overhead lines on poles. Depending on the final alignment of the bridge approaches and the roadway, there may be some interference with the power poles or lines. Relocation of up to two power poles and associated lines on Pennock Island might be required (the estimated cost of relocating two poles and associated electric and telephone lines is \$40,000).

4.3.7.5 Alternatives G2, G3, and G4

At the Revillagigedo Island landings of each of the proposed ferry routes, all project improvements would be seaward of any electrical and telephone lines, so there is no expected impact. Nor would any electrical or telephone lines on Gravina Island be affected by any of these alternatives.

4.4 RELOCATION IMPACTS

Should the Gravina Access Project require acquisition of real property, all property owners, without discrimination, would be compensated for their loss of property at fair market value and all displaced persons would be moved at no expense to them. Any relocation would comply with the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970" as amended. A detailed evaluation of each of the alignments with respect to property acquisition requirements is provided in Appendix C (*Conceptual Stage Relocation Study and Assessment of Right-of-Way Acquisition Costs*). There is sufficient existing housing in the community to accommodate those residents who would be relocated, although they may have to locate outside of their existing neighborhood. Businesses that may be displaced by an alternative would also have to locate in a different area of the community; the cost of relocating would be covered as part of the relocation process.

4.4.1 No Action Alternative

The No Action alternative would have no relocation impacts; no homes or businesses would have to be relocated.

4.4.2 Alternative C3(a)

Alternative C3(a) would require acquisition of property from 23 parcels. One residence would likely have to be relocated where Alternative C3(a) crosses Tongass Avenue. The proposed alignment of Alternative C3(a) would not require the relocation of any other residences or businesses.

4.4.3 Alternative C3(b)

Alternative C3(b) would require acquisition of property from 28 parcels. The different configuration of the Alternative C3(b) alignment in its approach to the bridge crossing would require more right-of-way within the residential area of Baker Street North and Bucey Avenue North along the hillside parallel to Tongass Avenue. The required right-of-way would encroach upon residential property and would therefore require the relocation of two residences on the hillside. The proposed alignment of Alternative C3(b) would not require the relocation of any other residences or businesses.

4.4.4 Alternative C4

Alternative C4 would require acquisition of property from 15 parcels. The right-of-way for Alternative C4 would traverse the hillside parallel to Tongass Avenue for approximately 0.5 mile, crossing through the approximate center of the Ketchikan Ready-Mix and Quarry property and through the construction company property. This location of the alignment would disrupt Ketchikan Ready-Mix and Quarry operations and may require the acquisition of portions of the Dawson Construction facilities including two trailers, which currently serve as an office. There are also two buildings (a construction office and three-bay large equipment garage) under construction that may have to be relocated with the selection of Alternative C4. The proposed alignment of Alternative C4 would not require the relocation of any other residences or businesses.

4.4.5 Alternative D1

Alternative D1 would require acquisition of property from 14 parcels. The right-of-way for Alternative D1 would traverse the hillside parallel to Tongass Avenue, north of the Cambria neighborhood, for approximately 0.3 mile, crossing through the Dawson Construction Company property and west of the Carlanna Construction quarry operations. This location of the alignment would disrupt operations of the Dawson Construction Company and may require relocation of portions of the construction company facilities, including two trailers presently located on the construction company property, which currently serve as an office. The proposed alignment of Alternative D1 would not require the relocation of any other residences or businesses.

4.4.6 Alternative F1 (Preferred)

Alternative F1 would require acquisition of property from 30 parcels. The proposed alignment of Alternative F1 would not require the relocation of any residences or businesses.

4.4.7 Alternative F3

Alternative F3 would require acquisition of property from 27 parcels. The proposed alignment of Alternative F3 would not require the relocation of any residences or businesses.

4.4.8 Alternative G2

Alternative G2 would require acquisition of property from 13 parcels. Alternative G2 would involve construction of a ferry terminal and parking facilities on Peninsula Point at the existing location of a Pro Mech aircraft hangar. The hangar and the associated aircraft operations would

have to be relocated. The proposed alignment of Alternative G2 would not require the relocation of any residences or other businesses.

4.4.9 Alternative G3

Alternative G3 would require acquisition of property from 15 parcels. Alternative G3 would involve construction of a ferry terminal and parking facilities at the current location of three commercial buildings—a gas station, a fast-food restaurant (Burger King), and the Gateway City Realty building, which currently has four businesses as tenants that would be displaced (Gateway City Realty, Basic Transportation Co., Matty's World of Toys, and Silver Basin). These six businesses would therefore have to be relocated with the selection of Alternative G3. The proposed alignment of Alternative G3 would not require the relocation of any other residences or businesses.

4.4.10 Alternative G4

Alternative G4 would require acquisition of property from 14 parcels. The proposed alignment of Alternative G4 would not require the relocation of any businesses or residences.

4.5 ECONOMIC IMPACTS

Table 4-1 presents a summary of the direct economic impacts from the Gravina Access Project. Section 4.5 discusses the direct economic impacts, Section 4.25.4 discusses economic impacts from construction, Section 4.26.3 discusses secondary economic impacts, and a complete description of all the economic impacts of the project alternatives is provided in the *Gravina Access Project Economic Impact Assessment* (Appendix D).

**TABLE 4-1
SUMMARY OF ECONOMIC IMPACTS ON KETCHIKAN GATEWAY BOROUGH 2003-2025**

Measures of Economic Effects	Alternative										
	Bridge							Ferry			
	C3(a)	C3(b)	C4	D1	F1	F3	F3 with channel mod.	G2	G3	G4	No Action
Life Cycle Costs (Net Present Value ¹ , 2001-2025, Millions of 2003\$)											
	158.3	132.8	157.6	106.1	191.4	168.4	179.4	90.0	98.0	88.0	12.6
Net Monetary Effect on Ketchikan ² (Net Present Value ¹ , 2001-2025, Millions of 2003\$)											
Medium	67.9	11.6	74.9	9.1	89.8	51.9	92.3	42.8	48.9	42.0	5.3
Net Benefits to Users (Net Present Value, 2001-2025, ³ Millions of 2003\$)											
Medium	55.2	62.3	64.2	70.0	27.1	22.6	22.6	(0.2)	(0.2)	2.0	0
Other Economic Costs ⁴ (Net Present Value, 2001-2025, ³ Millions of 2003\$)											
Medium	(7.0)	(7.3)	(8.0)	(6.7)	(1.8)	(0.7)	(0.7)	(1.0)	(4.1)	(0.4)	0
Total Employment ⁵ (Number of Employees, Cumulative for 2003- 2025)											
Medium	1,091	(439)	1,153	(492)	1,334	126	1,335	442	457	436	83

¹ Net present value calculated with a 4.2 percent real discount rate per Office and Management Budget Circular A-94 supplement issued November 2001.

² Includes direct and secondary (indirect and induced) effects of local construction and operations and maintenance expenditures, and reduced cruise-related and aviation-related spending.

³ From Quantification of User Economic Benefits for the Gravina Access Project, October 2002. Prepared by HLB Decision Economics, Inc. for HDR Alaska, Inc. Benefits are calculated in comparison to the No Action alternative.

⁴ Includes time delay for passengers traveling on local flights and opportunity cost for using public lands for right-of-way.

⁵ Employment is cumulative total of jobs over the 2003 to 2025 study period, which incorporates the construction period and 20-years of operating life. Employment includes direct and secondary (indirect and induced) employment. Negative numbers reflect the potential reductions from employment levels that might have occurred, given the assumptions on levels of reductions in cruise-related and aviation-related spending.

4.5.1 Economy and Economic Development

A long-term direct impact of the Gravina Access Project is the beneficial impact of operations and maintenance spending on the Ketchikan economy. The effect of this spending would depend on the particular alternative since the operations and maintenance costs of each alternative vary. The ferry alternatives (G2, G3, and G4) have the greatest operations and maintenance costs (\$3.3 million/year). The estimates of operations and maintenance-related spending expected to occur within Borough shown in Table 4-2 do not include any indirect or multiplier effects of the spending in the local area. These indirect effects (including the economic development that results because of improved access) are discussed in Section 4.26. A complete description of the economic impacts of the project alternatives is provided in Appendix D.

**TABLE 4-2
ESTIMATED OPERATIONS AND MAINTENANCE SPENDING
IN THE KETCHIKAN GATEWAY BOROUGH BY ALTERNATIVE**

<i>Alternative</i>	<i>Annual Operations & Maintenance (Millions of 2003\$)</i>
No Action	\$1.4
C3(a)	\$0.2
C3(b)	\$0.2
C4	\$0.2
D1	\$0.1
F1	\$0.1
F3	\$0.1
G2	\$3.3
G3	\$3.3
G4	\$3.3

If any of the bridge alternatives were selected, one additional impact would be the elimination of the ferry service between Gravina and Revillagigedo Islands. Based on past performance, elimination of the ferry would represent a small net financial gain (i.e., benefit) to the operator, the Borough, since historically the ferry has been an unprofitable operation. However, recent fare increases may result in the ferry service being profitable this year. In any event, the traveling public would benefit from the reduced travel cost to Gravina Island if a bridge alternative were selected rather than a ferry alternative because of the elimination of a toll to travel to and from the Island.

4.5.2 Employment

4.5.2.1 No Action Alternative

The No Action Alternative would have employment impacts related to periodic replacement of facilities and equipment, in addition to the jobs associated with operating the existing ferry service. There are approximately 16 annual operations and maintenance jobs associated with the No Action Alternative.

4.5.2.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

Operations and maintenance of the alternatives would create jobs in the region. Table 4-3 illustrates the total number of annual operation and maintenance jobs that would employ residents of the Borough for each alternative; additional jobs would go to workers from outside of the Borough.

**TABLE 4-3
ESTIMATED OPERATIONS AND MAINTENANCE JOBS IN THE
KETCHIKAN GATEWAY BOROUGH BY ALTERNATIVE**

<i>Alternative</i>	<i>Annual Operations & Maintenance Jobs</i>
No Action	16
C3(a)	2
C3(b)	2
C4	2
D1	1
F1	1
F3	1
G2	51
G3	51
G4	51

Operations and maintenance activities would also indirectly result in additional jobs being created in the region. Indirect impacts include full-time and part-time employment created as a result of the secondary round of spending by businesses, households, and local governments that support the project; these secondary impacts are discussed in Section 4.26.3.

4.6 JOINT DEVELOPMENT

There are no joint development projects associated with the Gravina Access Project.

4.7 TRANSPORTATION IMPACTS

4.7.1 Aviation

For each project alternative, direct impacts (both adverse and beneficial) on aviation are discussed under three aviation categories and related subcategories, as follows:

- ◆ Ketchikan International Airport, including airport property and facilities, airport access and circulation, and Part 77 airspace.
- ◆ Floatplane Facilities and Operations
- ◆ Helicopter Facilities and Operations

Parts of this discussion of impacts on aviation are based on the project report on aviation impacts, *Airport and Floatplane Facilities and Operational Effects*.⁴

The following figures are relevant to this Section 4.7.1:

- ◆ Figures 2.5 through 2.11, and 2.17 through 2.19 (depictions of alignments of each project alternative)

⁴ DOT&PF, *Gravina Access Project, Airport and Floatplane Facilities and Operational Effects*, prepared by HDR Alaska, December 2001.

- ◆ Figure 2.4—Ketchikan International Airport: Circulation and Parking (for build alternatives)
- ◆ Figure 3.10—Aviation Transportation Facilities
- ◆ Figure 3.11—Ketchikan International Airport: Existing Conditions

4.7.1.1 No Action Alternative

Ketchikan International Airport

The No Action Alternative would have no adverse impact on airport property; existing airport facilities; or Part 77 airspace in the vicinity of Ketchikan International Airport. This alternative would not improve access to or circulation around Ketchikan International Airport. Existing problems associated with convenience and reliability of access for passengers, airport tenants, emergency personnel and equipment, congestion around the airport terminal, and shipment of freight would continue.

Floatplane Facilities and Operations

The No Action Alternative would not affect existing floatplane facilities or operations.

Helicopters Operations and Facilities

The No Action Alternative would not affect helicopter operations or facilities.

4.7.1.2 Alternatives C3(a), C3(b), C4, and D1

Ketchikan International Airport

These alternatives would enhance access to Ketchikan International Airport by providing a hard link (bridge) from Ketchikan. Alternatives C3(a), C3(b), C4, and D1 include access and circulation roadways to and around the airport on Gravina Island. These would have no adverse impacts on airport facilities as they have been specifically laid out to avoid impacts on any facilities currently in use at the airport.

The existing parking and circulation system in the immediate vicinity of the terminal area would be modified to accommodate access from the bridges associated with Alternatives C3(a), C3(b), C4, and D1. Specifically, the access and circulation of vehicles and pedestrian traffic would be modified in front of the existing terminal area to accommodate entrance and exit ramps to the bridge. The terminal area would continue to have space available for short-term parking and a drop-off lane. Increased long-term parking demand would be relocated to a parking structure that is an element of the airport master plan (see Section 4.26 Secondary Impacts).

Alternative C3(a)

Alternative C3(a) would penetrate the horizontal surface of the Part 77 airspace by 21 feet and the transitional surface by 37 feet. According to the FAA preliminary analysis of this alternative, these penetrations would not impact current landing procedures for the airport under instrument

flight rules (IFR).⁵ The proposed bridge would be lighted and marked in accordance with FAA regulations and advisory circulars to mitigate the effects of the airspace penetration on aviation operations.

Alternative C3(b)

This alternative does not penetrate airspace surfaces, and would have no adverse effect on approaches or departures from Ketchikan International Airport.⁶ Although the Alternative C3(b) bridge would not penetrate Part 77 airspace, marking and lighting on the bridge would still conform to FAA regulations and advisory circulars.

Alternative C4

Alternative C4 would penetrate the horizontal surface of Part 77 airspace by 36 feet and the transitional surface by 64 feet;⁷ however, these penetrations are not expected to affect current instrument approach procedures for Ketchikan International Airport. Alternative C4 would have no direct adverse effect on standard Ketchikan International Airport approach and departure procedures for wheeled aircraft. The proposed bridge would be lighted and marked in accordance with FAA regulations and advisory circulars to mitigate the effects of the airspace penetration on aviation operations.

Alternative D1

This alternative does not penetrate airspace surfaces, and would have no adverse effect on approaches or departures from Ketchikan International Airport.⁸ Although the Alternative D1 bridge would not penetrate Part 77 airspace, marking and lighting on the bridge would still conform to FAA regulations and advisory circulars.

Floatplane Facilities and Operations

Alternatives C3(a), C3(b), C4, and D1 would have a direct adverse impact on floatplane operations, as the bridge presents a new obstruction in Ketchikan Class E airspace (i.e., the restricted airspace around Ketchikan and Tongass Narrows) and would further complicate floatplane operations within airspace that is currently congested.

Adverse impacts to floatplane operations would occur during those periods of inclement weather that require special visual flight rules (SVFR) and Exemption No. 4760 operations. According to a preliminary analysis and recommendation by the FAA Juneau Flight Standards District Office, these alternatives "...would hinder aircraft flying inbound from the west to Ketchikan Harbor."⁹ This analysis further states that the proposed bridges would, at a minimum, require modification of the boundaries of Exemption 4760 "...to exclude any airspace west of the airport. This would greatly reduce the effectiveness of Exemption 4760, to the point that less than 10 percent of the

⁵ Tony Wylie, Alaska Region Air Traffic Division, letter to Roger Healy, DOT&PF Project Manager, July 22, 2002.

⁶ Wylie, July 22, 2002.

⁷ Wylie, July 22, 2002.

⁸ Wylie, July 22, 2002.

⁹ Mick Green, Flight Standards District, Juneau, letter to John Schommer, FAA Flight Obstruction Specialist, July 15, 2002.

current operations conducted under Exemption 4760 would still be allowed.” Assuming approximately 2,000 SVFR operations per year (see description of SVFR operations in Section 3.7.1.4), the Alternatives C3(a), C3(b), C4, and D1) bridges would eliminate approximately 1,800 flights per year, or approximately 1.7 percent of the total number of floatplane operations in Ketchikan.

Thus, Alternatives C3(a), C3(b), C4, and D1 would have an adverse impact on floatplane operations in the form of operational delays due to changes in operating requirements.¹⁰ The FAA would evaluate, through a process separate from this EIS, the need to adjust or eliminate the minimum altitudes allowed under SVFR and/or Exemption No. 4760 as a result of Alternative C3(a), C3(b), C4, or D1. Proper lighting and marking of the bridge structure would reduce the risk of floatplanes colliding with the bridge.

Alternatives C3(a), C3(b), C4, and D1 would have no direct adverse impacts on the existing floatplane facilities at Ketchikan Harbor Floatplane Base, Murphy’s Pullout Floatplane Base, or other private facilities.

The alignment of Alternative C3(a), C3(b), and C4 would be very close to the existing floatplane base at Ketchikan International Airport. Under all three of these alternatives, a bridge pier would be located approximately 100 feet from the western end of the main floatplane dock, and would be centered along the primary floatplane taxi lane into and out of the turning basin. Another bridge pier would be located on the shoreline directly adjacent to the ramp to the transient floatplane dock. For Alternatives C3(a) and C4, the bridge height at this location would be approximately 100 feet above mean sea level, which would allow sufficient clearance for continued operation of the base but would adversely affect existing floatplane taxiing and turning patterns at the dock. For Alternative C3(b), the bridge height at this location would be approximately 10 feet above mean sea level, which would adversely affect continued operation of the facility. Alternative D1 would have no impact on these facilities.

Alternatives C3(a), C3(b), and C4 would also have a direct adverse impact on the waterway designated for take-offs and landings from the airport floatplane base (the NWW-SEE Waterway). Any of these bridges would transect the southern portion of the waterway and might require shortening the waterway from its current 9,500-foot length, or shifting the waterway to the north. Such a bridge would affect floatplane operations in that pilots would have to fly over the bridge or taxi under it. Alternative D1 would have no impact on this waterway facility.

Mitigation

Because of the proximity of bridge piers associated with Alternatives C3(a), C3(b), and C4 to the airport floatplane facilities, the ramp and dock would likely need to be relocated, at least during construction, and could require permanent relocation. Another option would be to keep the transient dock in place and provide access to it through a parking structure. Under such a scenario, the parking structure would be located on the road and ramp area currently used to access the transient float. Access to the ramp could be maintained from the bottom floor of the parking structure on a ramp of similar construction as currently exists. Development of a

¹⁰ DOT&PF, *Gravina Access Project Special Visual Flight Rules Analysis* prepared by HDR, December 2001.

parking structure is dependant upon future traffic conditions, which are discussed in Section 4.26, Secondary Impacts.

Helicopter Operations and Facilities

Alternative C3(a), C3(b), C4, or D1 would have no effects on helicopter operations or facilities.

4.7.1.3 Alternatives F1 (Preferred) and F3

Ketchikan International Airport

These alternatives would enhance access to Ketchikan International Airport by providing a hard link (bridge) from Ketchikan.

Alternatives F1 and F3 would cross Tongass Narrows approximately 3 miles south of the airport. Alternatives F1 and F3 include access and circulation roadways to and around the airport on Gravina Island. These would have no adverse impacts on airport facilities as they have been specifically laid out to avoid impacts on any facilities currently in use at the airport.

The proposed bridges do not penetrate any airspace surfaces and would have no effect on approaches or departures from Ketchikan International Airport.¹¹ Although Alternatives F1 and F3 bridge would not penetrate Part 77 airspace, marking and lighting on the bridge would still conform to FAA regulations and advisory circulars.

Floatplane Facilities and Operations

Alternatives F1 and F3 would have no adverse effect on floatplane facilities in the Ketchikan area.

The two bridges of Alternatives F1 and F3 would adversely affect floatplane operations because pilots would have to either fly over a bridge or taxi under it when traversing the East and West Channels. Proper lighting and marking of the bridge structures would help minimize the risk to floatplanes of collision with the bridge.

None of the bridges proposed under these alternatives would be within the boundaries of the Exemption 4760 airspace. Nonetheless, according to preliminary analysis by the FAA, the bridge locations are sufficiently close to the Exemption 4760 airspace that the exemption might require adjustment.¹² The direct effect on SVFR operations under Exemption 4760 would be, therefore, less severe under Alternatives F1 and F3 than under Alternatives C3(a), C3(b), C4, and D1. According to FAA, Alternative F3 would be favorable over Alternative F1 with respect to floatplane operations because Alternative F3 offers a lower bridge in the East Channel and aircraft are typically lower in the East Channel; “a high bridge in the East Channel would create a hazard for floatplanes during all operations, VFR or SVFR.”¹³

¹¹ Wylie, July 22, 2002.

¹² Wylie, July 22, 2002.

¹³ Green, July 15, 2002.

Based on conversations with FAA, DOT&PF assumes in this analysis that, with Alternative F1 or F3 in place, there would be a 10 percent or 5 percent reduction in SVFR operations, respectively. Assuming approximately 2,000 SVFR operations per year (see description of SVFR operations in Section 3.7.1.4), Alternatives F1 and F3 would eliminate approximately 200 and 100 flights per year, respectively; or less than 0.002 percent of the total number of floatplane operations in Ketchikan.

Helicopters Operations and Facilities

Neither Alternative F1 nor Alternative F3 would affect helicopter operations or facilities.

4.7.1.4 Alternative G2

Ketchikan International Airport

The Gravina Island terminus of Alternative G2 is approximately 2 miles north of the airport. Alternative G2 includes access and circulation roadways to and around the airport on Gravina Island. These would have no adverse impacts on airport facilities as they have been specifically laid out to avoid impacts on any facilities currently in use at the airport.

Alternative G2 would have no impact on Part 77 airspace or aviation operations at the airport.

Floatplane Facilities and Operations

Alternative G2 would have no effect on SVFR operations under Exemption 4760. Alternative G2 would introduce ferry vessel traffic across the northern end of the NWW-SEE Waterway used for floatplane operations, affecting a relatively small portion of the waterway. This would directly adversely impact floatplanes using that portion of the waterway for take-offs and landings. Alternative G2 would affect no other floatplane facilities.

Mitigation

The boundaries of the NWW-SEE Waterway could be shifted slightly to the south to lessen or eliminate any impacts on floatplane take-offs and landings. Alternatively, floatplane operations could avoid that portion of the waterway affected by Alternative G2.

Helicopters Operations and Facilities

Alternative G2 would have no impact on helicopter operations or facilities.

4.7.1.5 Alternative G3

Ketchikan International Airport

The Gravina Island terminus of Alternative G3 is approximately 0.6 mile south of the airport. Alternative G3 includes access and circulation roadways to and around the airport on Gravina Island. These would have no adverse impacts on airport facilities as they have been specifically laid out to avoid impacts on any facilities currently in use at the airport. Alternative G3 would not impact air space or aviation operations at the airport.

Floatplane Facilities and Operations

Alternative G3 would have no effect on SVFR operations under Exemption 4760. Alternative G3 would have no impact on floatplane facilities. This alternative would introduce ferry vessel traffic across the northern portion of the NW-SE Waterway, and would have a direct adverse impact on floatplane take-offs and landings in that waterway; however, the portion of the waterway affected would be relatively small. Alternative G3 would affect no other floatplane facilities.

Mitigation

The boundaries of the NW-SE Waterway could be shifted slightly to the south to lessen or eliminate any impacts on floatplane take-offs and landings. Alternatively, floatplane operations could avoid that portion of the waterway affected by Alternative G3.

Helicopters Operations and Facilities

Alternative G3 would have no impact on helicopter operations or facilities.

4.7.1.6 Alternative G4

Ketchikan International Airport

Alternative G4 would include development of a new ferry terminal adjacent to the existing terminal at Ketchikan International Airport. The alternative includes access and circulation roadways to and around the airport on Gravina Island. These would have no adverse impacts on airport facilities as they have been specifically laid out to avoid impacts on any facilities currently in use at the airport.

Alternative G4 would not impact air space or aviation operations at the airport.

Floatplane Facilities and Operations

This alternative would have no impact floatplane facilities or operations.

Helicopters Operations and Facilities

Alternative G4 would have no impact on helicopter operations or facilities.

4.7.2 Marine Transportation

This section describes the potential impacts on marine transportation. Considerable technical analyses have been completed to characterize the impacts of the Gravina Access Project alternatives on marine navigation. The technical reports detailing these analyses are provided in the following appendices to this EIS:

- ◆ Appendix E *Wind Climatology Technical Memorandum* presents joint probability wind speed and direction tables, an annual extreme value distribution with return periods, and monthly and annual wind statistics for the Ketchikan, Alaska area.

- ◆ Appendix F *Consequences of Various Channel Closures to Large Shipping* summarizes the consequences of closing East Channel and, alternatively, closing the north branch of Tongass Narrows to large vessels calling at Ketchikan.
- ◆ Appendix G *Reconnaissance of Vessel Navigation Requirements* provides a detailed analysis of the navigational requirements associated with each of the alternatives.
- ◆ Appendix H *Monte Carlo Navigation Simulation Technical Memorandum* describes the fast-time maneuvering simulation study of large cruise ships and Alaska ferries transiting Tongass Narrows under the alternative bridge sites of the Gravina Access Project.
- ◆ Appendix I *RTM STAR Center Report* provides the results of real-time simulations of navigation in Tongass Narrows with the project alternatives.
- ◆ Appendix J *Real Time Navigation Simulation Study (STAR Center) Technical Memorandum* is The Glosten Associates' analysis of the RTM STAR Center full-mission real-time simulation study.
- ◆ Appendix K *Effects on Cruise Ship Operations* explains the possible direct effects of project alternatives on the cruise ship industry and the indirect effects of those alternatives on the cruise lines and the Ketchikan community.

With respect to cruise ships as an element of marine navigation, this section presents the direct effects of the project alternatives (i.e., how alternatives affect cruise ship access to Ketchikan, mobility within Tongass Narrows, and durations of travel and port calls); whereas, the secondary impacts of changes in cruise ship traffic and navigation are presented in Section 4.26.4. Impacts related to cruise ship emissions are addressed in Section 4.10, Air Quality.

4.7.2.1 No Action Alternative

Cruise Ships

The No Action Alternative would have no impact on cruise ship operations or the Ketchikan docking and berthing areas and facilities used by the cruise ships. No new infrastructure or marine operations would be introduced to the project area.

Alaska Marine Highway System Ferry

The No Action Alternative would have no impact on AMHS ferry services or facilities.

Airport Ferry

The No Action Alternative would have no impact on the existing airport ferry service or facilities.

Tugs and Barges

The No Action Alternative would have no impact on tug and barge traffic in Tongass Narrows.

USCG Facilities and Operations and NOAA Vessels

The No Action Alternative would have no impact on the USCG Station or USCG operations. NOAA vessels would not be affected by this alternative.

Small Boats and Other Watercraft

The No Action Alternative would have no impact on the facilities for or the use of small boats, kayaks, or other watercraft in Tongass Narrows.

4.7.2.2 Alternatives C3(a) and C4

Cruise Ships

The bridges associated with Alternatives C3(a) and C4 would have navigational clearances of 200 feet (vertical) and 550 feet (horizontal), which would accommodate the passage of all ships currently transiting Tongass Narrows and those ships expected to be transiting Tongass Narrows in the foreseeable future. All cruise ships currently sailing in Alaska, as well as ships anticipated in the foreseeable future, would be able to pass under the Alternatives C3(a) and C4 bridges and through Tongass Narrows. The introduction of piers in the deep navigable waters of Tongass Narrows would introduce new, permanent, grounding and allision¹⁴ risks¹⁵ and increase the imperative for the existing custom and practice of one-way traffic for large vessels operating in Tongass Narrows.

AMHS Ferry

Alternatives C3(a) and C4 would have no impact on AMHS ferry facilities or operations. The vertical clearances of these bridges would be significantly higher than is required for AMHS ferries. The introduction of piers in the deep navigable waters of Tongass Narrows would introduce new, permanent, grounding and allision risks,¹⁶ however, the horizontal spans are substantially wider than the other navigational clearances in the AMHS system routes (e.g., Wrangell Narrows).

Airport Ferry

Airport ferry service would be discontinued under Alternatives C3(a) and C4, thereby reducing overall marine operations crossing Tongass Narrows, but not adversely affecting the access to Gravina Island currently provided by the ferry. The reduction in crossing pattern marine operations will increase the safety of ongoing long-channel transits of Tongass Narrows.

Tugs and Barges

The vertical and horizontal clearances of Alternatives C3(a) and C4 would be sufficient to accommodate tug and barge traffic in Tongass Narrows, and would not impact tug and barge

¹⁴ An allision is defined as a moving object colliding with a stationary object (e.g., a ship colliding with a bridge pier).

¹⁵ DOT&PF, *Gravina Access Project Monte Carlo Navigation Simulation Technical Memorandum*, prepared by The Glosten Associates, January 2002

¹⁶ Ibid.

operations. The introduction of piers in the deep navigable waters of Tongass Narrows would introduce new, permanent, grounding and allision¹⁷ risks.¹⁸

USCG Facilities and Operations and NOAA Vessels

Alternatives C3(a) and C4 would not impact USCG facilities, as the alternative alignments would be substantially north of the USCG facilities. Nor would the bridge affect USCG operations in Tongass Narrows. NOAA vessels would not be affected by this alternative.

Small Boats and Other Watercraft

Alternatives C3(a) and C4 would have no impact on the facilities for or the use of small boats, kayaks, or other watercraft in Tongass Narrows.

4.7.2.3 Alternatives C3(b) and D1

Cruise Ships

The height of the Alternative C3(b) and Alternative D1 bridges (120 feet) would preclude passage of large cruise ships, which would constrain the direction of their approach to the cruise ship dock in Ketchikan. This would have an adverse impact on the routes and travel times of cruise ships that currently pass through Tongass Narrows. Cruise ships would be required to approach the dock from the south only, whereas they currently can approach from (and depart to) either the north or south; for departure, the ships would be required to turn around and depart to the south. These approach and departure directions would be required regardless of a ship's ultimate direction of travel.

The majority of cruise ships that currently call at Ketchikan either arrive from or depart to the north. A 120-foot-high bridge would require northbound large cruise ships leaving the Port of Ketchikan to sail south of Gravina Island (through Nichols Passage) and around the western side of Gravina Island. Southbound vessels would enter Tongass Narrows from the south via Nichols Passage and then depart Ketchikan in the same fashion as today. The typical increase in route distance would be 30.5 nautical miles.¹⁹ Because the Port of Ketchikan would become effectively a one-way in and out for vessels over 120 feet, an additional turning movement would be required either when approaching the dock or after departure. The direct effects on the cruise ship operations would be expending extra fuel and sailing time, and changing their arrival and departure schedules. As a result, cruise ship operators could reduce port time in Ketchikan or possibly by-pass Ketchikan altogether.

Table 4-4 illustrates the additional transit time required under Alternative C3(b) and Alternative D1 to navigate around Gravina Island on northbound and southbound voyages. The analysis that produced these figures (i.e., *Gravina Access Project Effects on Cruise Ship Operations*; provided as Appendix K) assumed that large cruise ships use their maximum cruising speed

¹⁷ An allision is defined as a ship colliding with a stationary object (e.g., a bridge pier).

¹⁸ DOT&PF, *Gravina Access Project Monte Carlo Navigation Simulation Technical Memorandum*, prepared by The Glosten Associates, January 2002

¹⁹ DOT&PF, *Gravina Access Project Marine Navigation Conditions Summary Technical Memorandum*, prepared by The Glosten Associates, October 1999.

between Ketchikan and Juneau (this speed may be greater than that associated with their current schedules). Alternatives C3(b) and D1 would require 41 additional minutes of transit time for northbound voyages and 60 minutes of additional time for southbound voyages. These numbers were derived from mean transit speeds between Juneau and Ketchikan based on 2001 cruise ship data and the achievable schedule at maximum cruising speed. The additional transit time accounts for the needed turn upon arrival or just after departure to ensure the vessel is oriented south, and includes 15 minutes that must be allowed for casting off and getting underway, and 15 minutes for maneuvering to the berth and making fast.

TABLE 4-4
ANALYSIS OF SAILING TIME BETWEEN JUNEAU AND KETCHIKAN USING
MAXIMUM CRUISING SPEED FOR ALTERNATIVES C3(b) AND D1

<i>2001 Cruise Season</i>	<i>Baseline Hours between Ketchikan/Juneau</i>	<i>Average Hours at Max Cruise (knots)</i>	<i>Average Time Lost (minutes)</i>
Ketchikan to Juneau – 95 trips	16.56	17.23	41
Juneau to Ketchikan – 94 trips	16.49	17.48	60

Source: Running Time and Other Impacts on Large Cruise Ships, Fax Memo to HDR Alaska, Inc., Glosten Associates, August 28, 2001

Additional transit time would, in turn, reduce the length of port calls and usable port times for cruise ships. Estimates of reduced port call durations for Alternatives C3(b) and D1 are presented in Table 4-5.

TABLE 4-5
ESTIMATED NEW PORT CALL LENGTH – NORTHBOUND (NB) AND
SOUTHBOUND (SB) VOYAGES FOR ALTERNATIVES C3(b) AND D1

<i>Length of Port Call in 2001</i>	<i>Number of NB Port Calls</i>	<i>Number of SB Port Calls</i>	<i>NB</i>	<i>NB</i>	<i>SB</i>	<i>SB</i>
			<i>New Length of Port Call</i>	<i>Usable Port Time</i>	<i>New Length of Port Call</i>	<i>Usable Port Time</i>
6.5 hours or less	1	22	<5.8 hours	<4.3 hours	<5.5 hours	<4.0 hours
6.6 to 7.5 hours	5	79	<6.8 hours	<5.3 hours	<6.5 hours	<5.0 hours
7.6 to 8.5 hours	56	80	<7.8 hours	<6.3 hours	<7.5 hours	<6.0 hours
8.6 to 9.5 hours	25	86	<8.8 hours	<7.3 hours	<8.5 hours	<7.0 hours
9.6 hours or longer	9	14	9 to 10 hours	8 to 9 hours	9 to 10 hours	8 to 9 hours

Source: DOT&PF, Gravina Access Project Effects on Cruise Ship Operations prepared by Northern Economics and Klugherz & Associates, May 2003.

The operational and itinerary changes described above are estimated to reduce the number of port calls by two percent for large cruise ships; i.e., based on 2001 cruise ship traffic, there would be eight fewer port calls by large cruise ships in Ketchikan for Alternatives C3(b) and D1 (see Appendix K).²⁰ These effects would have adverse secondary economic effects on cruise ship lines, Ketchikan businesses that rely on the patronage of cruise ship passengers, and local government. The potential secondary economic impacts of changes in cruise ship operations are detailed in Section 4.26.3.4 (Secondary Impacts).

²⁰ This assumes a mid-range growth rate for cruise ship traffic to and from Ketchikan.

AMHS Ferry

A bridge having a vertical clearance of 120 feet would be high enough to accommodate passage of the AMHS ferries, and would not adversely impact existing AMHS ferry operations or facilities in Ketchikan. The introduction of piers in the deep navigable waters of Tongass Narrows would introduce new, permanent, grounding and allision risks²¹ however, the horizontal spans are substantially wider than the other navigational clearances in the AMHS system routes (e.g., Wrangell Narrows).

Airport Ferry

Airport ferry service would be discontinued under these bridge alternatives, thereby reducing overall marine operations crossing Tongass Narrows. The reduction in crossing pattern marine operations will increase the safety of ongoing long-channel transits of Tongass Narrows.

Tugs and Barges

The vertical and horizontal clearances of Alternatives C3(b) and D1 would be sufficient to accommodate tug and barge traffic in Tongass Narrows, and would not impact tug and barge operations.

USCG Facilities and Operations and NOAA Vessels

Alternatives C3(b) and D1 would have no impact on the USCG facilities or operations. NOAA vessels would not be affected by these alternatives.

Small Boats and Other Watercraft

Alternatives C3(b) and D1 would have no impact on the facilities for or the use of small boats, kayaks, or other watercraft in Tongass Narrows.

4.7.2.4 Alternative F1 (Preferred)

Cruise Ships

Cruise ships use the East Channel almost exclusively, and the 200-foot clearance of the East Channel Bridge would allow passage of large cruise ships. The introduction of bridge piers in the deep navigable waters of East Channel would introduce an incremental increase in grounding and allision risks at those locations.²² In addition, when considered with the fact that navigation of the East Channel currently involves passage through a constriction of the channel created by California and Idaho Rocks (approximate navigational clearance [width] of 476 feet), the placement of bridge piers in East Channel would add a second point of constriction in the channel by narrowing the channel width from approximately 1,100 feet to 550 feet. This second point of constriction would limit maneuvering opportunities in East Channel and the potential for groundings and allisions at other locations within the East Channel would increase.

²¹ DOT&PF, *Gravina Access Project Monte Carlo Navigation Simulation Technical Memorandum*, prepared by The Glosten Associates, January 2002

²² Ibid.

Marine pilots expressed concern over the bridges' angled crossings of East and West Channels. Discussions of these safety concerns are detailed in "Ketchikan Bridge Project, Port of Ketchikan, Alaska, Tongass Narrows, Summary Report," prepared by RTM STAR Center in Dania, Florida (see Appendix I). With the bridge crossing the main channel at an angle, the bridge piers are closer to the main channel than they would be if the bridge were perpendicular to the main channel, thus increasing the risk of allisions. Cruise ship pilots would likely alter their approach to the bridge to create a track line that is more perpendicular to the bridge.

Although the risk of allisions would increase with the presence of bridges over East and West Channels, Alternative F1 would not result in a reduction of cruise ship port calls in Ketchikan.

Mitigation. Project engineers investigated the possibility of realigning the Alternative F1 bridges so that they would cross perpendicular to East and West Channels to reduce the risk of allisions. A conceptual drawing of the realigned crossings is provided in Figure 4.1. If Alternative F1 were selected, DOT&PF would further investigate the possibility of realigning the bridges and evaluate the potential environmental impacts associated with the realignment.

AMHS Ferry

AMHS ferries usually use the West Channel to avoid cruise ship traffic and because there is less adjacent shoreline development and, thus, less need to slow down to control their wakes. The West Channel span of Alternative F1 would be 120 feet high, which would allow passage of the AMHS ferries and, thus, their continued use of West Channel. The introduction of piers in the deep navigable waters of Tongass Narrows would introduce new, permanent, grounding and allision risks²³ however, the horizontal spans are substantially wider than the other navigational clearances in the AMHS system routes (e.g., Wrangell Narrows).

Airport Ferry

Airport ferry service would be discontinued under the bridge alternatives, thereby reducing overall marine operations crossing Tongass Narrows. The reduction in crossing pattern marine operations will increase the safety of ongoing long-channel transits of Tongass Narrows.

Tugs and Barges

The vertical and horizontal clearances of Alternative F1 would be sufficient to accommodate tug and barge traffic in Tongass Narrows, and would not impact tug and barge operations.

USCG Facilities and Operations and NOAA Vessels

Alternative F1 would pass to the south of the USCG facilities south of Ketchikan, but would not impact those facilities or USCG operations. NOAA vessels would not be affected by this alternative.

Small Boats and Other Watercraft

Alternative F1 would have no impact on the facilities for or the use of small boats, kayaks, or other watercraft in Tongass Narrows.

²³ Ibid.

4.7.2.5 Alternative F3

Cruise Ships

Alternative F3 includes a low (60-foot vertical clearance) bridge over East Channel, and a higher bridge (200-foot clearance) over West Channel. The Alternative F3 bridges would be south of the Ketchikan cruise ship dock. This alternative would have an adverse impact on cruise ships calling at Ketchikan because it would require them to use West Channel or enter and exit Tongass Narrows from the north. Either option would require additional maneuvering and increased sailing time (and decreased port time).

Use of the West Channel by large cruise ships adds approximately 1.8 nautical miles to the running distance, adding approximately three minutes to total cruise ship run-times for southbound voyages, and 18 minutes to northbound voyages (Table 4-6). These delays could be reduced by ships using faster running speeds between Ketchikan and Juneau, however this would consume more fuel, thus increasing fuel costs (see Section 4.26.4). In addition, cruise ships would have to execute the equivalent of two 180-degree turns that are not required under the existing conditions. The two 180-degree turns would presumably be executed on that section of the voyage that is least time critical, or the maneuvers may be split between the northern and southern segments of the Ketchikan port call. Overall, this is estimated to add 30 to 40 minutes to the ships' harbor maneuvers. See Appendix K.

**TABLE 4-6
ANALYSIS OF SAILING TIME BETWEEN JUNEAU AND KETCHIKAN FOR
ALTERNATIVE F3 – PENNOCK ISLAND CROSSING**

<i>2001 Cruise Season</i>	<i>Baseline Hours between Ketchikan/Juneau</i>	<i>Average Hours at Max Cruise (knots)</i>	<i>Average Time Lost (minutes)</i>
Ketchikan to Juneau – 95 trips	16.56	16.60	3
Juneau to Ketchikan – 94 trips	16.49	16.79	18

Source: Running Time and Other Impacts on Large Cruise Ships, Fax Memo to HDR Alaska, Inc., Glosten Associates, August 28, 2001.

The use of West Channel also presents safety concerns for cruise ship lines and ship pilots. Discussions of these safety concerns are detailed in "Ketchikan Bridge Project, Port of Ketchikan, Alaska, Tongass Narrows, Summary Report," prepared by RTM STAR Center in Dania, Florida (see Appendix I). The RTM STAR Center study included full-mission computer generated simulation of large cruise ships maneuvering into and out of Ketchikan. The concerns presented in the report include comments from Ketchikan cruise ship pilots that West Channel with the Alternative F3 Bridge is too narrow to safely navigate large ships. The primary issue is that there is no margin for error at the bridge; e.g., a gust of wind, an engineering casualty, an error in responding to helm commands, or opposing traffic, would allow very little time (or space) to react and take sufficient evasive action. Other issues include risks associated with: a tidal current set toward Pennock Island; bank suction effects at the bridge site; maintaining vessel control in following winds and currents by increasing speed above the existing speed limit; and the need to execute a 120-degree turn around Pennock Reef, especially when the harbor has other maneuvering vessels and vessels at anchor.

The effects of increased running and maneuvering time and the safety concerns associated with transiting West Channel could result in a short-term four percent reduction in port calls by large cruise ships (i.e., 17 fewer port calls based on 2001 cruise ship traffic). Assuming a two- to three-year period of safe operations, it is anticipated that some of the ships that initially stopped calling at Ketchikan would return, either using West Channel or accessing the port from the north. It is estimated that, following this adjustment period, there would be a two-percent reduction in total large cruise ship port calls (i.e., eight fewer port calls based on 2001 cruise ship traffic).²⁴ See Appendix K.

The potential economic effects of changes in cruise ship operations are discussed in Section 4.26.3 (Secondary Impacts).

Marine pilots also expressed concern over the bridges' angled crossings of East and West Channels (see Appendix I). With the bridge crossing the main channel at an angle, the bridge piers are closer to the main channel than they would be if the bridge were perpendicular to the main channel, thus increasing the risk of allisions. Cruise ship pilots would likely alter their approach to the bridge to create a track line that is more perpendicular to the bridge.

Mitigation. If a portion of the West Channel were widened, as described in Section 2.1.2.6, the risks to large cruise ships transiting the West Channel would be minimized and no reduction in the number of port calls to Ketchikan would be expected. Project engineers investigated the possibility of realigning the Alternative F3 bridges so that they would cross perpendicular to East and West Channels also to reduce the risk of allisions. A conceptual drawing of the realigned crossings is provided in Figure 4.1. If Alternative F3 were selected, DOT&PF would further investigate the possibility of realigning the bridges and evaluate the potential environmental impacts associated with the realignment.

AMHS Ferry

As noted above, AMHS ferries usually use West Channel, and the high span over West Channel would allow continued use by the AMHS ferries. The AMHS ferries would not be able to transit East Channel. With cruise ships required to use the West Channel as well, marine traffic in the West Channel would increase. The current separation of AMHS traffic from cruise ship traffic by Pennock Island would cease. The added traffic could adversely impact AMHS ferry operations due to congested conditions in West Channel. In addition, the introduction of piers in the deep navigable waters of Tongass Narrows would introduce new, permanent, grounding and allision risks;²⁵ however, the horizontal spans are substantially wider than the other navigational clearances in the AMHS system routes (e.g., Wrangell Narrows).

Airport Ferry

Airport ferry service would be discontinued under the bridge alternatives, thereby reducing overall marine operations crossing Tongass Narrows. The reduction in crossing channel marine operations will increase the safety of ongoing long-channel transits of Tongass Narrows.

²⁴ This assumes a mid-range growth rate for cruise ship traffic to and from Ketchikan.

²⁵ DOT&PF, *Gravina Access Project Monte Carlo Navigation Simulation Technical Memorandum*, prepared by The Glosten Associates, January 2002

Tugs and Barges

The vertical and horizontal clearances of Alternative F3 would be sufficient to accommodate most tug and barge traffic in Tongass Narrows. Barges have been known to transit Tongass Narrows with container stacks and cargo that require air drafts of 64 feet; however, this is the maximum air draft requirement and does not represent the majority of barges in Tongass Narrows. Since the East Channel bridge has a vertical clearance of 60 feet above mean higher high water, tug masters could elect to wait for lower tides to navigate 64-foot high barges through East Channel rather than deciding to navigate these barges through West Channel. Barge operators may limit the height of their container stacks to avoid reliance on the tides or transits through West Channel. Therefore, operations of some barges may change as a result of Alternative F3.

USCG Facilities and Operations and NOAA Vessels

Alternative F3 would have no impact on USCG facilities; however, the 60-foot bridge over the East Channel would adversely affect operations of USCG vessels with air drafts greater than 60 feet, including the USCG cutter *Acushnet*, which has an air draft of 100 feet. Such vessels would have to use a northern approach to and departure from the USCG pier, which would require additional turning maneuvers for the ship to navigate around Pennock Island.

The NOAA Ship *Fairweather* would not be able to use the East Channel to reach its proposed mooring site south of the USCG pier. This would have an adverse impact on the proposed operations of this NOAA vessel because it would require additional turning maneuvers for the ship to navigate around Pennock Island when approaching from or departing to the south.

Small Boats and Other Watercraft

Alternative F3 would have no impact on the facilities for or the use of small boats, kayaks, or other watercraft in Tongass Narrows. Restriction of large vessel traffic to the West Channel could increase safety for watercraft using the East Channel exclusively.

4.7.2.6 Alternative G2

Cruise Ships

This alternative would introduce a new lane of regular ferry travel across Tongass Narrows, which is also used by in- and out-bound cruise ships. However, given the regularity of the ferry schedules and the current general compatibility of ferry and cruise ship operations at the existing airport ferry location, Alternative G2 would not have adverse impacts on cruise ship operations. This alternative is distant from the cruise ship dock in Ketchikan, and would not impact any facilities.

AMHS Ferry

As with cruise ship operations and facilities, the AMHS ferry operations and facilities would not be affected by Alternative G2.

Airport Ferry

The existing airport ferry would continue operations from its current location. Alternative G2 would supplement this service, and would reduce crowding on the ferries during peak usage, providing a benefit for the ferry passengers.

Tugs and Barges

Given the regularity of ferry schedules and the current general compatibility of ferry services and other marine navigation traffic in Tongass Narrows, Alternative G2 would not have adverse effects on tug and barge traffic.

USCG Facilities and Operations and NOAA Vessels

Alternative G2 would not impact USCG facilities or operations. NOAA vessels would not be affected by this alternative.

Small Boats and Other Watercraft

Although the additional ferry service of Alternative G2 would introduce more marine traffic into Tongass Narrows at a new location, it would not adversely impact the facilities for or use of boats, kayaks, and other watercraft in Tongass Narrows.

4.7.2.7 Alternative G3

Cruise Ships

The new ferry terminal facilities in Ketchikan would have no impact on cruise ship facilities. This alternative would introduce a new lane and regular ferry traffic across Tongass Narrows, but would not adversely impact cruise ship operations.

AMHS Ferry

Alternative G3 would have no impact on AMHS ferries.

Airport Ferry

The existing airport ferry would continue operations from its current location. Alternative G3 would supplement this service, and would reduce crowding on the ferries during peak usage, providing a benefit for the ferry passengers.

Tugs and Barges

Given the regularity of ferry schedules and the current general compatibility of ferry services and other marine navigation traffic in Tongass Narrows, Alternative G3 would not have adverse effects on tug and barge traffic.

USCG Facilities and Operations and NOAA Vessels

Alternative G3 would have no impact on USCG facilities and operations. NOAA vessels would not be affected by this alternative.

Small Boats and Other Watercraft

Alternative G3 would introduce new ferry facilities and ferry operations near the Ketchikan harbor, which has a high concentration of docks and related facilities for small boats. This alternative would likely increase marine congestion in the area around Ketchikan Harbor, which would adversely impact operations of small boats, kayaks, and other watercraft in that area. If the breakwater were extended for use as the ferry pier, watercraft at Ketchikan Harbor would likely be required to enter and exit the harbor from the north.

4.7.2.8 Alternative G4

Cruise Ships

Alternative G4 would offer enhanced airport ferry service and facilities from a location adjacent to the existing ferry. Ferry service across Tongass Narrows would be more frequent, but would not adversely impact cruise ship operations.

Airport Ferry

The existing airport ferry would continue operations from its current location. Alternative G4 would supplement this service, and would reduce crowding on the ferries during peak usage, providing a benefit for the ferry passengers.

AMHS Ferry

Alternative G4 would not impact AMHS ferry service or facilities.

Tugs and Barges

Given the regularity of ferry schedules and the current general compatibility of ferry services and other marine navigation traffic in Tongass Narrows, Alternative G4 would not have adverse effects on tug and barge traffic.

USCG Facilities and Operations and NOAA Vessels

Alternative G4 would not impact the USCG facilities and operations. NOAA vessels would not be affected by this alternative.

Small Boats and Other Watercraft

Alternative G4 would have no effects on the facilities for and the use of small boat, kayaks, and other watercraft in Tongass Narrows.

4.7.3 Vehicles

The direct effects of the Gravina Access Project alternatives on vehicles include impacts related to construction and impacts related to new infrastructure that creates new traffic patterns. Construction related impacts are described in Section 4.25. Traffic projections based on growth

induced by new access opportunities and the impacts of that traffic are secondary impacts and are described in Section 4.26.

The primary measure of direct impacts of the alternatives on vehicular travel (not related to construction) is based on how each alternative affects travel time to Ketchikan International Airport and developable land on Gravina Island from three key points of origin on Revillagigedo Island:

- ◆ The Ketchikan central business district (downtown),
- ◆ The U.S. Post Office at Ward Cove, and
- ◆ Carlanna Creek.

Table 4-7 (Travel Distances and Estimated Vehicular Travel Times) presents the calculated travel times for each of the project alternatives. Analysis is based on a travel speed of 5 miles per hour (mph) below the posted speed limit. On this table, the travel times to the airport that are shorter than the existing condition are shown in boldface. Because vehicular access to developable land on Gravina Island is not possible under existing conditions or the No Action Alternative, there is no such comparison for travel time to developable lands. All of the build alternatives would have a beneficial impact on vehicular transportation because they provide access from Revillagigedo Island to developable lands on Gravina Island.

**TABLE 4-7
TRAVEL DISTANCES AND ESTIMATED VEHICULAR TRAVEL TIMES**

Origin and Destination*	Distance (miles) and Vehicular Travel Times (minutes)									
	Existing Conditions/ No Action	C3(a)	C3(b)	C4	D1	F1	F3	G2	G3	G4
From Downtown	3.29	6.21	5.55	4.80	4.14	7.49	7.43	10.61	5.49	3.40
to Airport Terminal	27	14	12	11	11	13	13	42	35	25
From Ward Cove	5.04	5.49	4.83	6.61	4.48	14.77	14.71	8.12	9.70	5.15
to Airport Terminal	25	8	6	9	7	27	27	34	40	23
From Carlanna Creek	0.53	3.45	2.79	2.10	1.54	10.26	10.20	7.85	5.19	0.64
to Airport Terminal	19	6	4	3	3	21	21	34	34	17
From Downtown		8.72	8.71	7.31	6.65	4.01	3.95	5.86	2.44	6.31
to Developable Land		17	17	15	14	7	7	34	29	29
From Ward Cove		8.00	7.99	9.12	6.99	11.29	11.23	3.37	6.65	8.06
to Developable Land		11	11	13	10	21	21	26	34	27
From Carlanna Creek		5.96	5.95	4.61	4.05	6.78	6.72	3.10	2.14	3.55
to Developable Land		9	9	7	6	15	15	26	28	21

Boldface = Shorter Time Than Existing Condition

Ward Cove = Post Office at Ward Cove

Developable Land = Airport Development Zone on Gravina Island

* Downtown = Central Business District of Ketchikan, Milepost 0

Airport Terminal = Terminal of Ketchikan International Airport

4.7.3.1 No Action Alternative

Under the No Action Alternative, there would be no traffic improvements that would change vehicular access to Ketchikan International Airport or developable lands on Gravina Island. Vehicles would continue to use the existing airport ferry to access the airport and the travel time to the airport would be the same from any location in Ketchikan as under existing conditions. Vehicles would not be able to more conveniently access developable lands. However, use of trails would continue to provide access to other Borough and developable lands.

4.7.3.2 Alternatives C3(a), C3(b), C4 and D1

Alternatives C3(a), C3(b), C4, and D1 would have a beneficial impact on travel time from Ketchikan to the airport. These alternatives would also provide vehicular access to developable land on Gravina Island, which is a benefit associated with all of the build alternatives. Travel time to the airport would be shorter than under existing conditions, taking less than half the time from downtown Ketchikan, Ward Cove, and Carlanna Creek locations.

With Alternatives C3(a) and C3(b), access to developable lands on Gravina Island from downtown Ketchikan, Ward Cove, and Carlanna Creek locations would take 17, 11, and 9 minutes, respectively. The intersection of Signal Road and Tongass Avenue would be altered to accommodate both of these alternatives, resulting in a new traffic pattern at this intersection.

With Alternatives C4 and D1, access to developable lands Gravina Island from downtown Ketchikan, Ward Cove, and Carlanna Creek locations would all take less than 15 minutes. Both of these alternatives would require a new intersection with Tongass Avenue near Cambria Drive and the existing airport ferry terminal access point, resulting in a new traffic pattern in that area.

4.7.3.3 Alternatives F1 (Preferred) and F3

Alternatives F1 and F3 would have a beneficial impacts for travel from downtown Ketchikan to the airport, but would not reduce travel times from Carlanna Creek or Ward Cove. Travel time to the airport would be shorter than under existing conditions for vehicles originating in downtown Ketchikan and points south; however, vehicles originating in the Carlanna Creek area and points north of that would have slightly longer travel times (i.e., 2 minutes longer) than under existing conditions. Vehicle access to developable lands on Gravina Island would take 21 minutes from Ward Cove. Both of these alternatives would require a new intersection with Tongass Avenue south of downtown Ketchikan, resulting in a new traffic pattern in that area.

4.7.3.4 Alternative G2

Alternative G2 would have no impact on travel time to the airport. Travel time to the airport from downtown Ketchikan, Ward Cove, and Carlanna Creek would be longer using the Alternative G2 ferry rather than the existing airport ferry, which would continue to be operational under this alternative. Travel time to developable land on Gravina Island for vehicles originating in downtown Ketchikan, Carlanna Creek, and Ward Cove would be 34, 26, and 26 minutes, respectively. This alternative would require intersection improvements to the point of access for Peninsula Point from Tongass Avenue, resulting in a new traffic pattern in that area.

4.7.3.5 Alternative G3

Alternative G3 would have no impact on travel time to the airport. Travel time to the airport from downtown Ketchikan, Ward Cove, and Carlanna Creek would be longer using the G3 ferry rather than the existing airport ferry, which would continue to be operational under this alternative. Travel time to developable land on Gravina Island for vehicles originating in downtown Ketchikan, Carlanna Creek, and Ward Cove would be 29, 34, and 28 minutes, respectively. This alternative would require a new intersection with Tongass Avenue near the Plaza Mall, resulting in a new traffic pattern in that area.

4.7.3.6 Alternative G4

Alternative G4 would have a beneficial effect on travel time to the airport. Travel time to the airport from downtown Ketchikan, Ward Cove, and Carlanna Creek would be shorter under this alternative because the wait time for ferry transit across Tongass Narrows would be shorter considering that twice as many ferries would be operating from the same location. Travel time to developable land on Gravina Island for vehicles originating in downtown Ketchikan, Carlanna Creek, and Ward Cove would be 29, 21, and 27 minutes, respectively. This alternative would require improvements to the ferry terminal access point and its intersection with Tongass Avenue, but would not substantially change the traffic pattern in that area.

4.7.3.7 Effects of Wind – All Alternatives

The effects of high winds and inclement weather on any crossing of Tongass Narrows can be considered a direct impact to vehicular transportation. The design of the bridge alternatives must accommodate the wind loading on the structure itself as well as the safety implications of vehicles, bicycles, and pedestrians crossing during inclement weather. Ferries are also affected by extreme weather conditions. The effects of wind, tide, or waves in Tongass Narrows could individually or in combination make the ferry crossing unsafe. It would be up to the master of the ferry to determine whether or not the ferry sailing would be delayed until conditions improve. Such instances have been rare with respect to current airport ferry operations.

The structural design of all bridge alternatives includes wind loadings as one of the design criteria. This design loading is normally based on tables using historic records of wind speed and direction at the bridge location. Because of the surrounding land shapes, the prevailing wind direction and speed, and the height, a bridge crossing Tongass Narrows would most probably need to be modeled in a wind tunnel to obtain accurate values of probable maximum design wind speed and resultant force on the bridge. This would be used for design to ensure safety of the structure.

In addition, the design wind speed and its frequency would be used to evaluate safety of operations for the traveling public crossing the bridge. Currently, there are some bridges that restrict travel (for example, using automated signs) when wind velocities reach some predetermined velocity. These restrictions may be invoked on certain types of high profile vehicles, such as panel trucks, empty truck trailer combinations, or motor homes. Travel restrictions are undesirable; as an option, safety measures could be designed into the Tongass Narrows structure to avoid or minimize restrictions. These measures could include additional height barriers, or other types of wind-reducing appurtenances. If a bridge alternative were selected, the final combination of the Tongass Narrows bridge design and potential weather

induced travel restrictions would be determined with the cost, convenience, and ultimate safety of the traveling public in mind.

4.8 CONSIDERATIONS RELATING TO PEDESTRIANS AND BICYCLISTS

The No Action Alternative would have no impact on pedestrian and bicycle facilities. The build alternatives would benefit pedestrians and bicyclists by providing additional facilities. Existing bike paths and sidewalks on Tongass Avenue would not be disrupted and would be connected with the selected alternative.

Impacts on pedestrians and bicyclists are based on how each alternative affects travel time to Ketchikan International Airport and developable land on Gravina Island from three key points of origin on Revillagigedo Island: the Ketchikan central business district (downtown), the U.S. Post Office at Ward Cove, and Carlanna Creek. Analysis is based on a travel speed of 3 mph (4.4 feet per second) for pedestrians and 10 mph (14.7 feet per second) for bicyclists.

Table 4-8 (Travel Distances and Estimated Pedestrian Travel Times) and Table 4-9 (Travel Distances and Estimated Bicycle Travel Times) present the calculated travel times for each of the project alternatives. On these tables, the travel times to the airport that are shorter than the existing condition are shown in boldface. Because pedestrian and bicycle access to developable land on Gravina Island is not possible in a specific pedestrian/bicycle corridor under existing conditions or the No Action Alternative, there is no such comparison for travel time to developable lands.

TABLE 4-8
TRAVEL DISTANCES AND ESTIMATED PEDESTRIAN TRAVEL TIMES

Origin and Destination*	Distance (miles) and Pedestrian Travel Times (minutes)									
	Existing Conditions/ No Action	C3(a)	C3(b)	C4	D1	F1	F3	G2	G3	G4
From Downtown	3.29	6.21	5.55	4.80	4.14	7.49	7.43	10.61	5.49	3.40
to Airport Terminal	76	124	111	95	82	150	149	219	116	75
From Ward Cove	5.04	5.49	4.83	6.61	4.48	14.77	14.71	8.12	9.70	5.15
to Airport Terminal	111	109	96	132	90	295	294	169	201	110
From Carlanna Creek	0.53	3.45	2.79	2.10	1.54	10.26	10.20	7.85	5.19	0.64
to Airport Terminal	21	69	56	42	31	205	204	164	111	20
From Downtown		8.72	8.71	7.31	6.65	4.01	3.95	5.86	2.44	6.31
to Developable Land		174	174	145	132	80	79	123	54	133
From Ward Cove		8.00	7.99	9.12	6.99	11.29	11.23	3.37	6.65	8.06
to Developable Land		159	159	182	140	225	224	73	139	168
From Carlanna Creek		5.96	5.95	4.61	4.05	6.78	6.72	3.10	2.14	3.55
to Developable Land		119	119	92	81	135	134	68	49	78

Boldface = Shorter Time Than Existing Condition

* Downtown = Central Business District of Ketchikan, Milepost 0
Airport Terminal = Terminal of Ketchikan International Airport

Ward Cove = Post Office at Ward Cove
Developable Land = Airport Development Zone on Gravina Island

**TABLE 4-9
TRAVEL DISTANCES AND ESTIMATED BICYCLE TRAVEL TIMES**

Origin and Destination*	Existing Conditions/ No Action	Distance (miles) and Bicyclist Travel Times (minutes)								
		C3(a)	C3(b)	C4	D1	F1	F3	G2	G3	G4
From Downtown	3.29	6.21	5.55	4.80	4.14	7.49	7.43	10.61	5.49	3.40
to Airport Terminal	37	38	34	29	25	45	45	81	51	34
From Ward Cove	5.04	5.49	4.83	6.61	4.48	14.77	14.71	8.12	9.70	5.15
to Airport Terminal	47	34	30	40	27	89	89	65	76	44
From Carlanna Creek	0.53	3.45	2.79	2.10	1.54	10.26	10.20	7.85	5.19	0.64
to Airport Terminal	20	21	17	13	9	62	62	64	49	17
From Downtown		8.72	8.71	7.31	6.65	4.01	3.95	5.86	2.44	6.31
to Developable Land		52	52	43	40	24	24	53	33	52
From Ward Cove		8.00	7.99	9.12	6.99	11.29	11.23	3.37	6.65	8.06
to Developable Land		48	48	54	42	68	68	37	58	62
From Carlanna Creek		5.96	5.95	4.61	4.05	6.78	6.72	3.10	2.14	3.55
to Developable Land		35	35	27	24	41	41	36	31	35

Boldface = Shorter Time Than Existing Condition Ward Cove = Post Office at Ward Cove
 * Downtown = Central Business District of Ketchikan, Milepost 0 Developable Land = Airport Development Zone on Gravina Island
 Airport Terminal = Terminal of Ketchikan International Airport

4.8.1 No Action Alternative

Under the No Action Alternative, there would be no improvements that would change pedestrian and bicycle access to Ketchikan International Airport or developable lands on Gravina Island. Pedestrians and bicyclists would continue to use the existing airport ferry to access the airport and the travel time to the airport would be the same from any location in Ketchikan as for existing conditions. Pedestrians and bicyclists would not be able to more conveniently access developable lands; however, use of trails would continue to provide access to other Borough and developable land.

4.8.2 Alternatives C3(a) and C3(b)

Alternatives C3(a) and C3(b) would reduce pedestrian travel times to the airport from points north of the existing ferry terminal, but would increase pedestrian travel time to the airport from points south of the existing ferry terminal. Without ferry service, travel times for pedestrians originating from points south of the existing airport ferry terminal on Revillagigedo Island to the airport would be substantially longer; whereas, travel times for pedestrians originating from the Signal Road area and points north of that would be shortened. Bicyclists traveling to the airport from all locations on Revillagigedo Island would experience shorter or comparable travel times using the Alternative C3(a) or C3(b) bridge rather than using the existing airport ferry.

Alternatives C3(a) and C3(b) would have a beneficial impact on pedestrian and bicycle access to developable land on Gravina Island. Pedestrian and bicycle access to developable lands on Gravina Island would be improved as a result of the road development on Gravina Island, which would include combined use shoulders/pedestrian walkways/bikepaths. The time of travel for

pedestrians from downtown Ketchikan to developable lands would be almost 3 hours (i.e., 174 minutes) and less than 1 hour (52 minutes) for bicyclists.

4.8.3 Alternatives C4 and D1

Without ferry service, travel times for pedestrians originating from points south of the existing airport ferry terminal on Revillagigedo Island to the airport would be longer. Travel times for pedestrians originating from points north of the existing ferry terminal on Revillagigedo Island to the airport would be longer for Alternative C4 than under existing conditions, but shorter for Alternative D1.

These alternatives would improve bicycle travel time to the airport. Bicyclists traveling to the airport from all locations on Revillagigedo Island would experience shorter travel times using the Alternative C4 or D1 bridge as compared to travel times using the existing airport ferry.

Alternatives C4 and D1 would improve pedestrian and bicycle access to developable land on Gravina Island. Pedestrian and bicycle access to developable lands on Gravina Island would benefit from road development on Gravina Island, which would include combined use shoulders/pedestrian walkways/bikepaths. The time of travel for pedestrians from downtown Ketchikan and the Ward Cove area to developable lands would be over 2 hours (i.e., 132 to 182 minutes) and less than 1 hour (43 to 54 minutes) for bicyclists. Pedestrians and bicyclists traveling from the Carlanna Creek area would have shorter travel times to developable land: 81 to 92 minutes for pedestrians and 24 to 27 minutes for bicycles.

4.8.4 Alternatives F1 (Preferred) and F3

Without ferry service, travel times for pedestrians originating from the Carlanna Creek area and points north of the existing airport ferry terminal on Revillagigedo Island to the airport would be approximately 3 hours longer than the time it takes pedestrians to reach the airport using the existing airport ferry. Thus, Alternatives F1 and F3 would have an adverse impact on pedestrian and bicycle travel times to the airport. Pedestrians traveling to the airport from downtown Ketchikan would experience travel times that are nearly double what it currently takes on the airport ferry. Bicyclists traveling to the airport from all locations on Revillagigedo Island would experience longer travel times using the Alternative F1 and F3 bridges as compared to travel times using the existing airport ferry.

Alternatives F1 and F3 would have a beneficial impact on access to developable lands on Gravina Island. Pedestrian and bicycle access to developable lands on Gravina Island would benefit from road development on Gravina Island, which would include combined use shoulders/pedestrian walkways/bikepaths. The time of travel for pedestrians to developable lands range from about 1 hour and 20 minutes (i.e., from downtown Ketchikan) to almost 4 hours (from the Ward Cove area). The time of travel for bicyclists to developable lands range from less than half an hour (i.e., from downtown Ketchikan) to just over one hour (from the Ward Cove area).

4.8.5 Alternatives G2 and G3

All of the ferry alternatives include continued operation of the existing airport ferry; therefore, the new ferry would provide an additional access option for pedestrians and bicyclists. Thus, these alternatives would have no impact on pedestrian and bicycle travel times to the airport. For

Alternatives G2 and G3, travel times for pedestrians and bicyclists to the airport using the new ferry would be longer than the travel time using the existing ferry.

Alternatives G2 and G3 would have a beneficial impact on access to developable lands on Gravina Island. Pedestrian and bicycle access to developable lands on Gravina Island would benefit from road development on Gravina Island, which would include combined use shoulders/pedestrian walkways/bikepaths. Access to developable land would be possible from both the existing and the new ferries, providing additional access options for pedestrians and bicycles.

4.8.6 Alternative G4

All of the ferry alternatives include continued operation of the existing airport ferry; therefore, the new ferry would provide an additional access option for pedestrians and bicyclists. Alternative G4 would have a beneficial impact on pedestrian and bicycle travel time to the airport. For Alternative G4, travel times for pedestrians and bicyclists traveling to the airport using the new ferry would be shorter than the travel time under existing conditions using the airport ferry because the co-location of the two ferries would reduce the amount of time spent waiting for the transit across Tongass Narrows.

Alternatives G4 would have a beneficial impact on access to developable lands on Gravina Island. Pedestrian and bicycle access to developable lands on Gravina Island would benefit from road development on Gravina Island, which would include combined use shoulders/pedestrian walkways/bikepaths.

4.9 GEOLOGY, TOPOGRAPHY, AND WIND

4.9.1 Geology and Topography

None of the project alternatives would adversely affect any unique or significant geologic feature.

4.9.1.1 No Action Alternative

The No Action Alternative would have no effect on the topography in the project area. No excavation would be required; therefore, no changes to the existing landforms would occur.

4.9.1.2 Alternatives C3(a), C3(b), C4, D1, and F1 (Preferred)

On Revillagigedo Island, construction of these bridge alternatives would require blasting to remove bedrock. With very little overburden in the area, the risk of slides caused by blasting is minimal. There are no known historic slides in the areas where blasting would be required. A geotechnical investigation would be conducted during final design of the selected alternative to identify any localized slope stability problems and devise an approach to removing material. On Gravina and Pennock Islands, the roadway would require minimal blasting to remove bedrock; in most areas, the road could be constructed using surface scrapers. On all three islands, such removal of surface sediments, soils, and bedrock to accommodate roadway construction and grading would alter the topography along the roadway corridor.

4.9.1.3 Alternative F3

No blasting of bedrock on Revillagigedo Island is expected under the Alternative F3 bridge alternative.

On Gravina and Pennock Islands, the roadway would require minimal blasting to remove bedrock; in most areas, the road could be constructed using surface scrapers. On all three islands, such removal of surface sediments, soils, and bedrock to accommodate roadway construction and grading would alter the topography along the roadway corridor.

Blasting and dredging in West Channel would be required for the proposed channel modifications of West Channel, resulting in the removal of approximately 79,000 cubic yards of material (bedrock, gravel, silts). These actions would permanently alter the configuration of the channel bottom at that location.

4.9.1.4 Alternatives G2 and G4

On Revillagigedo Island, no blasting of bedrock is expected under Alternatives G2 and G4. On Gravina Island, the roadway would require minimal blasting to remove bedrock. In most areas of Gravina Island, the road could be constructed using surface scrapers. Removal of surface sediments, soils, and bedrock to accommodate roadway construction and grading under any of these alternatives would alter the topography along the roadway corridor.

4.9.1.5 Alternative G3

Alternative G3 would not require blasting of bedrock on Revillagigedo Island. On Gravina Island, the roadway would require minimal blasting to remove bedrock. In most areas of Gravina Island, the road could be constructed using surface scrapers. Removal of surface sediments, soils, and bedrock to accommodate roadway construction and grading under this alternative would alter the topography along the roadway corridor.

Dredging may be required to provide adequate navigation depths for the ferry terminal on Revillagigedo Island. Such dredging would modify the configuration of the channel bottom at this location.

4.9.2 Soils

4.9.2.1 No Action Alternative

The No Action Alternative would have no effect on soils in the project area.

4.9.2.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

The temporary adverse effects of construction on soils and surface sediments are described in Section 4.25 (Construction Impacts). These alternatives would require excavation of surface sediments and/or soils along the entire over-land alignment. Removal of surface sediments and soils to accommodate roadway construction and grading under any of these alternatives would not adversely affect any unique or significant soil materials.

4.9.3 Wind

The Gravina Access Project would have no effect on wind. The effects of wind on vehicular access for all of the project alternatives are described in Section 4.7.3.7.

4.10 AIR QUALITY IMPACTS

4.10.1 Pollutants of Concern

Air pollutants of concern associated with the Gravina Access Project are elevated concentrations of:

- ♦ Carbon monoxide (CO) from vehicular emissions at intersections, interchanges, and other similar sites with high vehicle densities and slow speeds.
- ♦ Particulate matter with a diameter equal to or less than 10 microns (PM₁₀), resulting primarily from construction activities that generate fugitive dust.

4.10.2 Emissions

4.10.2.1 No Action Alternative

The No Action Alternative would have no effect on air quality in the Ketchikan area. There would be no increases in emissions of carbon monoxide or PM₁₀ as a result of the No Action Alternative.

4.10.2.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

Other than impacts related to construction and traffic associated with the build alternatives, there are no air quality impacts associated with the project build alternatives. Emissions from marine vessels are regulated only for opacity levels (see Section 4.10.1), and no new violations of the regulated levels are expected to result from implementation of any of the project alternatives.

Compared with existing conditions, and assuming the same level of traffic, all build alternatives would result in greater vehicle emissions as a result of increased road travel. Alternatives adding the greatest length of new road (i.e., Alternatives F1 and F3) would have greater vehicle emissions than alternatives with the least amount of new road. With the bridge alternatives, emissions from the airport ferry would be eliminated, resulting in an overall decrease in emissions, compared with the No Action Alternative (see Table 4-10). The ferry alternatives, however, would double the ferry emissions and add vehicular emissions, resulting in an overall increase in emissions. None of the emissions increases associated with any of the project alternatives would affect the air quality in Ketchikan.

**TABLE 4-10
ESTIMATED ANNUAL EMISSIONS ASSOCIATED WITH ALTERNATIVES***

Alternative	<i>Emissions (tons per year)</i>				
	<i>SO₂</i>	<i>PM</i>	<i>NO_x</i>	<i>CO</i>	<i>HC</i>
No Action	0.23	1.26	47.11	11.87	2.47
C3(a)	0.07	0.02	1.18	7.21	0.81
C3(b)	0.07	0.03	1.24	7.54	0.85
C4	0.07	0.02	1.16	7.06	0.80
D1	0.06	0.02	1.08	6.55	0.74
F1	0.14	0.05	2.48	15.13	1.70
F3'	0.12	0.04	2.14	13.04	1.47
G2	0.52	2.54	95.34	30.53	5.71
G3	0.53	2.54	95.42	31.03	5.76
G4	0.52	2.54	95.20	29.74	5.62

* Based on 450 vehicle trips per day between Revillagigedo Island and Gravina Island.

The adverse effects of emissions from construction activities associated with the build alternatives are described in Section 4.25 (Construction Impacts). The adverse effects of projected traffic levels on air quality are described in Section 4.26 (Secondary Impacts).

4.11 NOISE IMPACTS

The adverse effects of construction-related noise by the build alternatives are described in Section 4.25 (Construction Impacts). The adverse effects of projected traffic levels on noise are described in Section 4.26 (Secondary Impacts).

4.11.1 No Action Alternative

Noise levels in the Ketchikan area would not increase as a result of the No Action Alternative.

4.11.2 Alternatives C3(a), C3(b), C4, D1, G2, G3, and G4

If Alternative C3(a), C3(b), C4, D1, G2, G3, or G4 were constructed, traffic volumes on the new alignment initially would be similar to existing traffic volumes on the airport ferry, which are lower than the traffic projections for 2025. There are no adverse noise impacts associated with the 2025 traffic volumes (see Section 4.26), therefore there would be no adverse noise impacts when the constructed alternative first becomes operational.

4.11.3 Alternatives F1 (Preferred) and F3

If Alternative F1 and F3 were constructed, traffic volumes on the new alignment initially would be similar to existing traffic volumes on the airport ferry, which are lower than the traffic projections for 2025. There are no adverse noise impacts associated with the 2025 traffic volumes (see Section 4.26), therefore there would be no adverse noise impacts when the constructed alternative first becomes operational.

Flight paths of floatplanes departing Ketchikan Harbor Floatplane Base may be altered by the presence of a bridge over the East and West Channels, which could increase sound levels for some Pennock Island residents. Typically, floatplanes taking off to the south but bound for points north make their northward turn at the south end of Pennock Island. With the Alternative F1 or Alternative F3 bridges in place, floatplanes may need to make their northward turn north of the bridge, which would involve flying over the northern end of Pennock Island, where many of the residences on Pennock Island are located. Residents of this area could experience increased noise from floatplane traffic as a result this altered flight pattern.

4.12 WATER QUALITY IMPACTS

The following sections generally describe the potential direct effects of the project alternatives on water quality in Tongass Narrows, streams, wetlands, ponds, and other waterbodies. See Section 4.25 (Construction Impacts) for the temporary adverse effects of project construction activities on water quality. See Section 4.26 (Secondary Impacts) for a discussion of the indirect impacts of the project on water quality.

4.12.1 No Action Alternative

Under the No Action Alternative, the ferry between Revillagigedo and Gravina Islands would continue to be operated. Pollutants would continue to be washed off the ferry terminals into Tongass Narrows and be produced by the ferry itself. Pollutants might include particulates, petroleum products, metals, and solvents.

4.12.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), and F3

The water quality of Tongass Narrows and freshwater streams and creeks on Gravina Island could be adversely affected by pollutants in runoff from the bridges and roadways including particulate matter, metals, and petroleum products from vehicle emissions and road maintenance activities. Because there is currently no upstream development along the creeks and streams on Gravina Island, the proposed roadways and bridges could lower the existing water quality in these water bodies.

Mitigation

Impacts on water quality would be minimized through appropriate design to reduce runoff from the roadways directly into Tongass Narrows or freshwater creeks. Best management practices, such as revegetation of road slopes, filtration of runoff through vegetation, and control of runoff to prevent erosion, would further limit pollution.

4.12.3 Alternatives G2, G3, and G4

The water quality of Tongass Narrows and freshwater creeks could be adversely affected by pollutants in runoff from the ferry terminals and roadways, and by ferry vessel emissions. These pollutants could include petroleum products, metals, and particulate matter from the operation and maintenance of the ferry, ferry terminals, and road links. Bridge and road crossings of Gravina Island creeks and watersheds could have the same detrimental effect on water quality as described for Alternatives C3(a), C3(b), C4, D1, F1, and F3 (see Section 4.12.2).

Mitigation

Impacts on water quality would be minimized by limiting direct runoff from the terminals and roadways into Tongass Narrows and creeks. Effective revegetation, filtration of runoff through vegetation, and use of erosion control measures would further limit adverse effects on water quality.

4.13 PERMITS

The COE, ADEC, USCG, and DNR would require permits to implement the Gravina Access Project build alternatives. Permits and approvals for temporary construction activities would also be necessary from COE, DNR, NOAA Fisheries, USFWS, and the EPA.

Permit requirements for all of the alternatives are summarized below. The draft application for the COE Section 404 permit is contained in Appendix L, along with a draft Section 404(b)(1) analysis and preliminary jurisdictional determination. The 404(b)(1) analysis was prepared for COE to supplement the EIS analysis of wetlands and waterbodies and to satisfy COE requirements. DOT&PF will continue to coordinate development proposals with the Borough and City with respect to local permit requirements.

4.13.1 No Action Alternative

No permits or certifications would be required for the No Action Alternative.

4.13.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), and F3

The bridge alternatives would require the following federal, state, and local permits:

- ◆ COE, Section 404 Permit for fill in wetlands and waters of the United States, and Section 10 permit for work in navigable waters. See also Appendix L.
- ◆ USCG Section 9 Bridge Permit.
- ◆ Coastal Zone Consistency Review.
- ◆ DNR, Title 41 Fish Habitat Permit for crossings of Airport Creek, Government Creek, and, for the Pennock alternatives, two unnamed creeks in Gravina.
- ◆ EPA, NPDES Construction Permit.
- ◆ Borough and City of Ketchikan permits and approvals, as required.

4.13.3 Alternatives G2, G3, and G4

Ferry alternatives would require the following permits:

- ◆ COE, Section 404 Permit for fill in wetlands and/or waters of the United States, and Section 10 permit for work in navigable waters. See also Appendix L.
- ◆ Coastal Zone Consistency Review.
- ◆ DNR, Title 41 Fish Habitat Permit for crossings of Airport and Government Creeks.
- ◆ EPA, NPDES Construction Permit.

- ◆ Borough and City of Ketchikan permits and approvals, as required.

4.14 WETLAND AND VEGETATION IMPACTS

Table 4-11 (Impacts on Wetlands, Ponds, and Uplands [Acres]) gives the number of acres of wetlands (by types) that would be directly affected by each project alternative. Figure 3.16 shows the locations of alternatives relative to wetlands, ponds, and uplands.

**TABLE 4-11
IMPACTS ON WETLANDS, PONDS, AND UPLANDS (ACRES)**

Wetland Type*	No Action Alternative	Bridge Alternatives						Ferry Alternatives		
	No Action	C3(a)	C3(b)	C4	D1	F1	F3	G2	G3	G4
Forested Wetlands	0.0	15.6	14.2	10.6	8.0	24.5	13.0	14.2	10.0	7.7
Shrub/Scrub Wetlands	0.0	3.1	3.0	3.1	3.0	17.9	14.4	2.9	6.5	2.9
Muskegs	0.0	25.3	25.1	25.1	25.1	60.9	57.7	25.3	29.4	24.8
Intertidal Marshes and Meadows	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.7	0.1
Total Wetland Impacts	0.0	44.1	42.4	39.0	36.3	103.3	85.2	42.5	47.5	35.4
Ponds	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Uplands (Nonwetlands)	0.0	5.1	9.1	10.4	8.6	10.7	4.8	7.6	7.0	4.7

* Impacts on marine waters other than mapped intertidal marshes and meadows are shown in Table 4-12 (Potential Impacts on EFH [Acres]).

Section 4.25 (Construction Impacts) describes the temporary effects of project construction on wetlands and vegetation. Section 4.26 (Secondary Impacts) provides a discussion of the indirect impacts of the project on wetlands and vegetation.

4.14.1 Wetlands

Direct, long-term impacts on wetlands would be primarily permanent loss resulting from placing roadway and ferry or bridge facilities in wetland areas. The project design would minimize such use of wetlands to the extent practicable. Appendix M provides a detailed description of impacts to wetlands potentially resulting from the project alternatives.

4.14.1.1 No Action Alternative

The No Action Alternative would have no effect on wetlands.

4.14.1.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

All build alternatives would cross wetlands within the project area. All alternatives except for F1 and F3 would each eliminate approximately 35 to 47 acres of wetlands. Alternatives F1 and F3 would eliminate the greatest amount of wetlands—approximately 103 and 85 acres, respectively—because they would require the most new roadway construction. The wetlands in the project area are extensive, and the proportion of wetlands that would be converted to transportation facilities under any of the build alternatives would be small.

Forested Wetlands

All build alternatives would result in the elimination and alteration of forested wetlands. Overall, Alternative F1 would have the greatest impact on forested wetlands. Some of the support that forested wetlands provide to adjacent streams (e.g. woody debris and invertebrates from overhanging vegetation) would be eliminated. Impacts on forested wetlands would occur primarily northwest of the airport and on Revillagiedo Island.

Elimination of forested wetlands would result in increased runoff, altered surface and subsurface drainage patterns, loss of wildlife habitat, and slight changes in plant community composition in forested wetlands adjacent to the road due to increased sunlight in the understory. Impacts on wildlife from human activity would extend beyond the project footprint.

Shrub/Scrub Wetlands

All build alternatives would result in the loss and alteration of shrub/scrub wetlands along the lengths of the roadway on Gravina Island. Alternatives F1 and F3 would have the greatest impacts because they have the greatest length of road. Loss of shrub/scrub wetlands would result in increased runoff, altered surface and subsurface drainage patterns, and loss of wildlife habitat. The area of shrub-scrub wetlands that supports adjacent stream ecosystems would be diminished. Impacts on wildlife from human activity would extend beyond the project footprint.

Muskegs

All build alternatives would result in the loss and alteration of muskegs. Impacts on muskegs would occur primarily west and south of the airport on Gravina Island, and along road routes on Pennock Island. Alternatives F1 and F3 would have the greatest impacts because they have the greatest length of road. A road across muskeg wetlands could alter the flow patterns of both surface and subsurface water, eliminate wildlife habitat, reduce the amount of organic material exported to downstream ecosystems, and cause slight changes in plant community composition as a result of altered drainage patterns and runoff of pollutants to the wetlands. Impacts on wildlife from human activity would extend beyond the project footprint.

Intertidal Marshes and Meadows

All build alternatives would result in the removal and alteration of intertidal marshes and meadows in the vicinity of Government Creek. Alternatives G2 and G3 would also eliminate intertidal marshes and meadows at their terminal areas (Lewis Point and south of the airport, respectively). Potential direct impacts resulting from removal of this highly productive habitat include loss of important feeding areas for terrestrial and aquatic species, loss of nurseries for young fish, and loss of organic matter produced in these marshes and exported to deeper marine waters. Impacts on wildlife from human activity would extend beyond the project footprint.

Mitigation

Final mitigation would be based on discussions among DNR, FHWA, COE, and other resource management agencies. Detailed mitigation measures would be developed and adhered to as a condition of future federal permits. Measures that would be employed include:

- ◆ Use of steep fill slopes to minimize the project footprint
- ◆ Effective revegetation of cut and fill slopes to minimize sediment loading of runoff and maximize pollutant filtering
- ◆ Minimization of surface disturbance beyond the footprint during construction
- ◆ Clear marking of construction limits to minimize accidental disturbance and any consequent temporary and permanent impacts
- ◆ Effective use of culverts to maintain natural drainage patterns to the degree possible
- ◆ Minimization of encroachment into upper intertidal saltmarsh where the roadway curves around the southern end of the runway into the Government Creek estuary
- ◆ Off-site compensatory mitigation or in lieu fee payment for unavoidable wetlands losses.

4.14.2 Vegetation

4.14.2.1 No Action Alternative

There would be no adverse impact on upland vegetation as result of the No Action Alternative.

4.14.2.2 Alternatives C3(a), C3(b), C4, and D1

Alternatives C3(a), C3(b), C4, and D1 would require the permanent removal of upland vegetation on some steep slopes and high knobs on Revillagigedo Island, near areas that are already developed. The upland vegetation affected by these alternatives would be primarily western hemlock/Sitka spruce forest in the relatively undisturbed areas and alder thickets in more disturbed areas. The project roadway would require the permanent removal of upland vegetation in or adjacent to currently developed areas around the airport on Gravina Island. Loss of vegetation would cause loss of wildlife habitat, and would increase the volume of surface runoff. Table 4-11 provides the total amount of upland and wetland vegetation impacted by each of these alternatives.

4.14.2.3 Alternatives F1 (Preferred) and F3

Alternatives F1 and F3 would require removal or cause shading of upland forest vegetation on the west side of Pennock Island and on the Gravina Island shoreline. The upland vegetation affected by these alternatives would be primarily western hemlock/Sitka spruce forest in the relatively undisturbed areas and alder thickets in more disturbed areas. The project roadway would require the permanent removal of upland vegetation in or adjacent to currently developed areas around the airport on Gravina Island. Loss of vegetation would cause loss of wildlife habitat, and would increase the volume of surface runoff. Table 4-11 provides the total amount of upland and wetland vegetation impacted by each of these alternatives.

4.14.2.4 Alternative G2

Alternative G2 would require removal of undisturbed spruce/hemlock forest at Lewis Point on Gravina Island. The upland vegetation affected by these alternatives would be primarily western hemlock/Sitka spruce forest in the relatively undisturbed areas and alder thickets in

more disturbed areas. The project roadway would require the permanent removal of upland vegetation in or adjacent to currently developed areas around the airport on Gravina Island. Loss of vegetation would cause loss of wildlife habitat, and would increase the volume of surface runoff. Table 4-11 provides the total amount of upland and wetland vegetation impacted by this alternative.

4.14.2.5 Alternatives G3 and G4

The upland vegetation affected by these alternatives would be primarily western hemlock/Sitka spruce forest in the relatively undisturbed areas and alder thickets in more disturbed areas. The project roadway would require the permanent removal of upland vegetation in or adjacent to currently developed areas around the airport on Gravina Island. Loss of vegetation would cause loss of wildlife habitat, and would increase the volume of surface runoff. Table 4-11 provides the total amount of upland and wetland vegetation impacted by each of these alternatives.

4.14.2.6 Mitigation

Final project design would seek to minimize direct impacts on these resources by defining narrow clearing limits and using disturbed areas for staging.

4.15 WATERBODIES AND WILDLIFE IMPACTS

Direct adverse impacts on water bodies and wildlife would result from roadway stream crossings, roadway placement within terrestrial areas that serve as wildlife habitat, placement of bridge piers in Tongass Narrows, placement of pilings for ferry terminals on the shoreline of Tongass Narrows, and placement of fill on the margins of Tongass Narrows.

Section 4.25 (Construction Impacts) provides a discussion of the temporary impacts on water bodies and wildlife during project construction. Section 4.26 (Secondary Impacts) provides a discussion of the indirect impacts of the project on water bodies and wildlife.

4.15.1 Water Bodies

4.15.1.1 No Action Alternative

There would be no modifications to water bodies in the project area.

4.15.1.2 Alternatives C3(a), C3(b), C4, and D1

These bridge alternatives would require the placing of piers in Tongass Narrows, which would affect water flow locally, but would not alter general flow patterns in Tongass Narrows.

All of these alternatives would entail placing fill for bridge approach roadway over a 4- to 7-acre area in Tongass Narrows in front of the airport and in the estuarine waters at the mouth of Government Creek. This would alter only local flow patterns. None of these alternatives includes a roadway that would cross Government Creek. These alternatives include roadway that would cross two channels of Airport Creek.

Mitigation

Effects of fill in Tongass Narrows and adjacent to Government Creek would be mitigated by minimizing the fill footprint and designing stable fills that do not erode. In addition, the project design would maintain natural streamflow conditions under the Airport Creek bridges and culvert design would accommodate storm water flow, not result in scour, and allow fish passage. The adverse impacts of roadway crossings of Airport Creek would be mitigated by using bridges at the crossings. All construction in and around anadromous fish streams will take place when stream disturbances would have the least impact on anadromous fish species. In-water work areas, except for stream crossings by construction equipment, will be isolated from flowing waters of all anadromous fish streams. In addition, gravels and streambed material will be used in the bottoms of culverts.

4.15.1.3 Alternative F1 (Preferred)

On Gravina Island, Alternative F1 includes roadway crossings of Airport Creek (two channels), Government Creek, and several other smaller unnamed creeks. The natural hydrology of streams placed in culverts would be altered. This alternative would also require fill (<1 acre) in Tongass Narrows in front of the airport and in the Government Creek estuary. This fill would alter local flow patterns.

Mitigation

The adverse impacts of crossing creeks would be mitigated at the larger creeks (two channels of Airport Creek, Government Creek, one unnamed creek) by using bridges. The minimum volume of fill would be placed in Tongass Narrows, and its slopes would be stabilized against erosion. Changes to the hydrology of smaller creeks would be minimized by designing culverts that are appropriately sized and placed, accommodate storm water flow, and do not cause scour.

4.15.1.4 Alternative F3

On Gravina Island, Alternative F3 includes roadway crossings of Airport Creek (two channels), Government Creek, and several other smaller unnamed creeks. The natural hydrology of streams placed in culverts would be altered. This alternative would also require less than 1 acre of fill in Tongass Narrows in front of the airport and in the Government Creek estuary for bridge placement. This fill would alter local flow patterns.

This alternative would require the removal of approximately 79,000 cubic yards of material (bedrock, gravel, silts) from the West Channel for the proposed channel modifications. This would widen the channel and modify the localized flow regime, but would not affect overall flow through the channel.

Mitigation

The adverse impacts of crossing creeks would be mitigated at the larger creeks (two channels of Airport Creek, Government Creek, one unnamed creek) by using bridges. The minimum volume of fill would be placed in Tongass Narrows, and its slopes would be stabilized against erosion. Changes to the hydrology of smaller creeks would be minimized by designing culverts

that are appropriately sized and placed, accommodate storm water flow, and do not cause scour.

4.15.1.5 Alternatives G2, G3, and G4

The ferry alternatives would require placing ferry docks in near-shore and intertidal areas of both Revillagigedo and Gravina Islands. These alternatives would also require placing fill in intertidal and subtidal areas of Tongass Narrows to accommodate staging and parking areas at the ferry terminals. Alternative G2 would most likely require fill at both terminals, Alternative G3 at just the Gravina Island terminal, and Alternative G4 would likely require only a small amount of fill at both terminals. The structures and fill associated with the ferry alternatives would have localized impacts on water flow, but would not alter general flow patterns in Tongass Narrows.

The roadway on Gravina Island associated with these alternatives would require road crossings of two channels of Airport Creek, and fill placed in Tongass Narrows in front of the airport and alongside the Government Creek estuary. The fill in Tongass Narrows would affect flow patterns only locally. In addition, Alternative G3 includes roadway that would cross Government Creek.

Mitigation

The adverse impacts of the Government and Airport Creek crossings would be mitigated by using bridges. The effects of fill in Tongass Narrows and adjacent to Government Creek would be mitigated by minimizing the fill footprint and designing stable fills that do not erode.

4.15.2 Ponds

4.15.2.1 No Action Alternative

There would be no adverse impact on ponds as a result of the No Action Alternative.

4.15.2.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

On Pennock and Revillagigedo Islands, no impacts on ponds are expected as a result of any of the build alternatives.

All build alternatives might eliminate small ponds within muskeg areas on Gravina Island. Filling ponds for roadway construction would result in a permanent loss of pond habitat.

4.15.3 Marine Habitat

Appendix N provides a detailed description of impacts to marine habitat potentially resulting from the project alternatives. This section provides a summary of that report.

4.15.3.1 No Action Alternative

The No Action Alternative would have no effect on marine resources.

4.15.3.2 Alternatives C3(a) and C4

These bridge alternatives would require a pier in near-shore waters on the eastern side of Tongass Narrows that could impact bull kelp beds. However, these beds would likely re-establish on the lower intertidal rock or concrete structure of the pier. Deep-water piers in mid-channel would develop a rich community of marine organisms.

On the western side of Tongass Narrows, the required piers will be located in an area that currently supports part of a near-continuous eelgrass bed that is interspersed with beds of kelp and an area of bull kelp. In the area where the bridge would extend southward, parallel to the airport runway, the bridge would shade and require six to seven acres of fill in an area with near-continuous eelgrass or kelp beds. Shading of marine habitats would reduce their productivity. This alternative would require placing fill in the Government Creek estuary, which would cause a loss of marine habitat and shallow subtidal organisms.

4.15.3.3 Alternative C3(b)

This bridge alternative would have impacts similar to those of Alternative C3(a) and C4, except that it would avoid some pier placement and shading impacts on kelp, eelgrass, and other shallow-water organisms off the barge dock and the beach north of the airport floatplane dock by crossing over deeper water.

4.15.3.4 Alternative D1

This bridge alternative would adversely affect marine habitats, but fewer such resources than the other bridge alternatives near the airport (i.e., C3[a], C3[b], and C4). This is because no pier would be required in near-shore waters on the eastern side of Tongass Narrows, and the length and area of shoreline affected by the bridge and road along the southern half of the airport shoreline would be shorter. About four acres of marine habitat would be filled.

4.15.3.5 Alternative F1 (Preferred)

Alternative F1 would likely have few impacts on eelgrass and kelp beds. The East Channel bridge of Alternative F1 would cross kelp beds on both the eastern and western shores at approximately 200 feet above the water. Because the bridge would be so high, little reduction in productivity of those kelp beds from shading is expected. Piers on both sides would avoid productive shallower near-shore waters.

The West Channel bridge crossings of Alternative F1 would require three piers in Tongass Narrows. Two of these would be placed in deeper waters, likely avoiding direct impacts on marine vegetation, but the western pier would be in shallower waters that support kelp and/or eelgrass beds. The West Channel bridge of Alternative F1 would be 120 feet above the water surface over these beds and over the mid- and upper intertidal vegetation along Gravina and Pennock Islands. Because the bridge is so high, little reduction in productivity is expected.

4.15.3.6 Alternative F3

The bridge construction associated with Alternative F3 would likely have few impacts on eelgrass and kelp beds. The eastern take-off of Alternative F3 from Revillagigedo Island for the East Channel bridge would require an abutment along the shoreline in the vicinity of the south

dump. This shoreline contains mixed gravel-sand beaches interspersed with much debris, such as broken glass and metal. The East Channel bridge of Alternative F3 would cross kelp beds on both the eastern and western shores at approximately 60 feet above the water. Shading by this bridge would likely reduce the productivity of those kelp beds. Piers on both sides would avoid productive shallower near-shore waters.

The West Channel bridge crossings of Alternative F3 would require two piers in Tongass Narrows. These piers would likely avoid direct impacts on marine vegetation because they would be placed in deeper waters. The West Channel bridge of Alternative F3 would be 200 feet above the water surface over these beds and over the mid- and upper intertidal vegetation along Gravina and Pennock Islands. Because the bridge is so high, little reduction in productivity is expected.

Blasting and dredging associated with the proposed channel modifications in the West Channel would remove approximately 14 surface acres of subtidal slopes and associated vegetation from areas adjacent to Gravina and Pennock Islands. This action would eliminate interspersed eelgrass and kelp beds located in this area. However, this vegetation may reestablish itself after project completion. The proposed channel widening could also adversely affect the densities of hardshell clams (littleneck and butter) located within the project impact area.

4.15.3.7 Alternative G2

Construction of a ferry terminal at Peninsula Point on Revillagigedo Island would fill over a portion of the rich rocky intertidal face of the point. However, because of the steepness of this face, the net area affected would be relatively small, and similar organisms would reestablish on the new hard structures placed for the terminal.

Construction of the ferry terminal at Lewis Point on the western side of Tongass Narrows would likely eliminate areas of kelp and eelgrass that lie offshore of the rocky point and in silty-sand pocket beaches at the base of the rocky intertidal outcrops. These same pocket beaches have very high densities of butter and littleneck clams.

4.15.3.8 Alternative G3

Under this alternative, placement of a ferry terminal at Bar Point on Revillagigedo Island would disrupt a portion of the rich rocky intertidal bench at this site. Beds of eelgrass, kelp, and other algae offshore of Bar Point could be eliminated by project-related dredging and/or filling to extend the existing pier.

A band of kelp and other algae would also likely be eliminated by dredging at the proposed western ferry terminal near East Clump Island on Gravina Island. The ferry access terminal would also be located on a relatively broad intertidal bench that has a mix of habitat types, with bedrock outcrops in a mixed-soft (cobble/gravel/silt) lower beach and a mixed gravel/cobble upper beach. This mix of habitat types supports a diverse community of organisms (including hard-shell clams, which are abundant on the lower beach), and would be eliminated.

4.15.3.9 Alternative G4

This alternative would require construction of new ferry terminals near the existing terminals on each side of Tongass Narrows. Both terminals would be close to deep water and would require

little, if any, dredging. Also, both would be constructed in areas that are already riprapped, and thus would avoid impacts on natural intertidal areas. Narrow bands of bull kelp lie offshore of the proposed eastern terminal and would be eliminated in the area of construction.

4.15.3.10 Marine Habitat Mitigation for All Build Alternatives

Mitigation for adversely affected marine habitat will be determined at the time of project permitting with input from ADF&G, NOAA Fisheries, COE, and USFWS.

4.15.4 Wildlife—Aquatic Species

4.15.4.1 Marine Mammals

No Action Alternative

The No Action Alternative would involve continued slight disturbance of marine mammals in the project area.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

All build alternatives would adversely impact marine mammals in Tongass Narrows. Direct impacts could include the loss and alteration of aquatic habitat, loss of food sources and cover, disturbance by increased noise levels, and temporary and/or permanent displacement. Marine mammals could be exposed to increased noise from project operation (vehicles driving on the bridge and ferry engines); most marine mammals would likely move away from any excessive noise. Direct impacts could also involve collisions between marine mammals and ferries; however, this is not likely because marine mammals in general tend to avoid collisions by using their echolocation capabilities. Section 4.20 (Threatened and Endangered Species) describes potential impacts to Steller sea lions and humpback whales.

Mitigation

All project-related activities would conform to the pertinent provisions of the Marine Mammal Protection Act and the Endangered Species Act.

4.15.4.2 Anadromous Fish

No Action Alternative

The No Action Alternative would not adversely affect anadromous fish in the project area.

Alternatives C3(a), C3(b), C4, and D1

Alternatives C3(a), C3(b), C4, and D1 would require bridge crossings that could affect anadromous fish streams. These alternatives would require a bridge crossing at two channels of Airport Creek. Alternatives C3(a), C3(b), C4, and D1 would also require placement of fill immediately adjacent to the lowermost segment of Government Creek, which is habitat for anadromous fish. Placement of fill in the Government Creek estuary would cause a permanent loss of brackish marsh in the estuary. Placing concrete, rock, and other fill materials in intertidal and subtidal areas would displace fish and permanently eliminate foraging habitat and cover.

This permanent habitat removal could have long-term adverse effects on anadromous and marine fish species such as salmon, Pacific halibut, Pacific herring, sablefish and rockfish, causing a direct loss of EFH in Tongass Narrows.²⁶

Communities of small organisms typical of natural hard-bottom areas would develop on bridge piers and provide cover to small fish. Placing bridge piers in Tongass Narrows would have a slight effect on the movements of juvenile anadromous fish in near-shore areas, particularly where the bridge structure parallels the shore. However, the fish would easily swim around the structures.

The bridge structures could slow the growth of eelgrass beds (an important habitat for juvenile salmon during their migration and an area of refuge for salmon and other small fish) by partially shading the beds. Less robust eelgrass beds would provide less eelgrass blade area to support aquatic insects and zooplankton (important food source for juvenile salmon).

Alternatives F1 (Preferred) and F3

Alternatives F1 and F3 would require bridge crossings that could affect anadromous fish streams. These alternatives would require bridge crossings of two channels of Airport Creek, a bridge crossing at Government Creek, and a bridge crossing at an unnamed creek south of Government Creek. Another anadromous fish stream would be crossed with a culvert.

Placing bridge piers in Tongass Narrows would have a slight effect on the movements of juvenile anadromous fish in near-shore areas. However, the fish would easily swim around the structures. As with the other bridge alternatives, bridge piers would replace a small area of ocean bottom habitat with a community of organisms that would establish on the piers. The road along the Government Creek estuary and the front of the airport would require filling habitat used by anadromous fish.

Alternatives G2, G3 and G4

The roadways associated with Alternatives G2, G3, and G4 would require bridge crossings that could affect anadromous fish streams. These alternatives would require a bridge crossing at two channels of Airport Creek and placement of fill along the front of the airport and immediately adjacent to the lowermost segment of Government Creek, which is habitat for anadromous fish. Placement of fill in the Government Creek estuary would cause a permanent loss of brackish marsh area in the estuary. Direct impacts from these ferry alternatives would result from placement of pilings for ferry terminals in Tongass Narrows. Placing ferry docks in Tongass Narrows would have a slight effect on the movements of juvenile anadromous fish in near-shore areas. However, the fish would easily swim around the structures.

Mitigation for All Build Alternatives

All anadromous stream crossings would be designed to minimize impacts on proper stream function and to provide passage to both anadromous and resident fish. All road structures crossing other fish habitat would be designed to provide passage for resident fish. To mitigate the effects of placing bridge piers in near-shore areas, all such structures would be located in a manner that would leave a near-shore migration corridor (down to at least -5 feet mean lower

²⁶ DOT&PF, *Gravina Access Project Biology Report*, prepared by HDR Alaska and Pentec Environmental, October 2001.

low water [MLLW]) clear of obstruction. The footprint of fill placed in marine waters would be minimized. Compensation for unavoidable impacts to anadromous fish habitat would be provided in the form of stream restoration and enhancement activity.

4.15.4.3 Marine Fish

No Action Alternative

The No Action Alternative would not adversely affect marine fish in the project area.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

The adverse impacts of the build alternatives on marine fish would be similar to the impacts on anadromous fish in Tongass Narrows, discussed in Section 4.15.4.2 (Anadromous Fish), above. In particular, impacts on eelgrass beds could reduce the availability of spawning sites for Pacific herring and other marine fish. Herring and their eggs and larvae are an important source of food for a wide variety of fish, mammals, and birds. In addition, the loss of soft-bottom substrate to bridge pier foundations would reduce habitat for halibut and other bottom-dwelling species.

Placing concrete, rock, and other fill materials or removing materials in intertidal and subtidal areas would displace fish and permanently eliminate spawning and foraging habitat. This permanent habitat removal could have long-term effects on some fish species (such as Pacific herring, surf smelt, and Pacific sand lance) that depend on the middle to upper intertidal and subtidal zones for spawning and rearing.

4.15.4.4 Essential Fish Habitat

Table 4-12 characterizes the acreage loss of EFH for each alternative. See Appendix O, Essential Fish Habitat Assessment for more information on impacts to EFH.

TABLE 4-12 POTENTIAL LOSS OF ESSENTIAL FISH HABITAT (ACRES)										
Type of Essential Fish Habitat	No Action	Bridge Alternatives						Ferry Alternatives		
		C3(a)	C3(b)	C4	D1	F1	F3 ¹	G2	G3 ²	G4
Freshwater	0.0	0.08	0.08	0.08	0.08	0.16	0.16	0.08	0.12	0.08
Marine	0.0	6.55	6.59	6.82	4.12	0.41	14.56	0.92	1.62	0.40
Total	0.0	6.63	6.67	6.90	4.20	0.57	14.72	1.00	1.74	0.48

¹ Assumes channel modification would be required

² Does not include potential dredging requirements at Bar Point

No Action Alternative

The No Action Alternative would not adversely affect EFH in the project area.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), and F3

Direct adverse effects of the bridge alternatives would include loss and alteration of EFH, which could cause loss of spawning areas, food sources, and cover, and permanent displacement of fish species. The placement of concrete, rock, and other fill materials in intertidal and subtidal areas in front of the airport and in the Government Creek estuary would displace fish and permanently eliminate spawning, foraging, and nursery habitat. Alternatives F1 and F3 would require placing a culvert in an anadromous fish stream that would cause loss of EFH. Alternative F3 would have the greatest potential loss of EFH (14.72 acres) due to dredging in the West Channel. Newly exposed soil and rock surfaces would be recolonized over a period of several years. Newly exposed lower rock at depths from the lower intertidal zone to about -20 feet MLLW would be recolonized by epibenthic biota similar to that seen at low tide levels on the existing west shore including red algae, kelp, and a variety of other small species. Subtidal rock will be colonized by a wide variety of invertebrates such as coral (*Balanophyllia elegans*), erect bryozoan (*Dendrobenia lichenoides*), scallop (*Chalmys hasata*), gastropods (*Scabrotrophon maltzani* and *Trichotropus cancellata*), white limpet (*Acmaea mitra*), sea peach (*Halocynthia auranthium*), and several other hydroids and bryozoans. A variety of red algae are expected to form an understory and large *Laminaria* species are expected to form an overstory. Bull kelp will recolonize at depths down to about -20 to -25 feet MLLW. Red algae will form the deepest zone and may extend to -50 feet MLLW.

Alternatives G2, G3, and G4

Direct adverse effects of the ferry alternatives would include loss and alteration of EFH, which could cause loss of spawning areas, food sources, and cover, and permanent displacement of fish species. All alternatives would require the placement of concrete, rock, and other fill materials in front of the airport and in the Government Creek estuary, which would displace fish and permanently eliminate important feeding and nursery habitat for young salmonid species and marine fish. Dredging in the offshore area of Bar Point may be required for Alternative G3, which would also result in the loss of EFH; however, neither the need for dredging nor potential dredged material quantities and location have been determined and are not included in this analysis.

4.15.5 Wildlife—Amphibians

4.15.5.1 No Action Alternative

There would be no effect on amphibian species as a result of the No Action Alternative.

4.15.5.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

Roadways associated with all of the alternatives would eliminate some habitat potentially used by the rough-skinned newt and the western toad. Direct impacts would include filling wetlands and uplands, clearing of habitat adjacent to roadways, and amphibian losses due to vehicle strikes.

4.15.6 Wildlife—Birds

4.15.6.1 No Action Alternative

There would be no effect on birds as a result of the No Action Alternative.

4.15.6.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

All build alternatives would result in a permanent loss of habitat for birds. This includes a variety of habitats (including marine waters, freshwater wetlands, and forests) that support some 160 bird species. All build alternatives would require construction of a new road. This would eliminate habitat within the road footprint (including the loss of food sources, cover, breeding grounds, and roosting sites), reduce habitat quality adjacent to the road, and increase disturbance of avian species by human activity.

Northern Goshawk

The northern goshawk, listed as an Alaska species of special concern, may use the project area and adjacent areas for nesting and foraging. However, northern goshawks use old growth and mature forest habitat, which is limited in the project area. Direct impacts from construction of a road and other associated disturbances would result in permanent removal of foraging habitat and increased disturbance from human activity. In addition, disturbances associated with road construction could potentially cause nest failure and abandonment in goshawk territories. No documented goshawk nesting occurs on Gravina or Revillagigedo Island.²⁷

Bald Eagles

All proposed build alternatives have the potential to disturb breeding eagles due to the proximity of the alternatives to known nests. No bald eagle nest trees would need to be removed. Unmitigated proximity impacts could include disturbance and stress to the eagles, possibly to the point of nest abandonment. Of the potential impacts on the bald eagle, the roadway construction phase would be the most disturbing; see Section 4.25 (Construction Impacts). The resulting new roads, ferry docks, and bridges would reduce perching and feeding areas for eagles along the shoreline and inland. Other possible direct impacts could include bald eagles being struck by vehicles while foraging for carrion on or along the new roadway.

Alternative G2 is located immediately adjacent to a bald eagle nest located at Lewis Point. Alternative G2 would be designed to avoid direct impacts to the nest tree. Alternative D1 would lie within 250 feet of a nest, and Alternative C4 would be located within 400 feet of a nest. Other alternatives are not located within 660 feet of any known bald eagle nests.

Mitigation

If the selected alternative would impact a bald eagle nest, DOT&PF would work with USFWS to develop mitigation measures. Biologists would be required to monitor construction activities around eagle nests, or adjacent construction activities (defined as work within 100 meters or blasting within one half mile) would not occur during the nesting season.

²⁷ Craig Flatten, Wildlife Biologist, Alaska Department of Fish and Game, personal communication Sirena Brownlee, HDR Alaska, 2002.

4.15.7 Wildlife—Land Mammals

The indirect impacts of the increase in access to Gravina and Pennock Islands on wildlife populations are discussed in Section 4.26 (Secondary Impacts) and Section 4.27 (Cumulative Impacts). Roads act as barriers to land mammal movement and fragment habitat. Some animals will avoid the road altogether, which might be a detriment to those animals' fitness. Some animals will choose to use the new road as an easy ground travel corridor aiding the survival of some animals, but could lead to some animals' deaths due to collisions with vehicles.

4.15.7.1 Sitka Black-Tailed Deer

No Action Alternative

There would be no effect on Sitka black-tailed deer as a result of the No Action Alternative.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

All build alternatives would result in a loss and alteration of deer habitat. Direct impacts would include loss of food sources and cover, loss of winter habitat, fragmentation of habitat, permanent displacement from habitats within and adjacent to land footprints, and incidental deaths from vehicle collisions. Alternative G2 could interfere with the access of deer to winter foraging habitat immediately north of the airport.

4.15.7.2 Alexander Archipelago Wolf

No Action Alternative

There would be no effect on Alexander Archipelago wolves as a result of the No Action Alternative.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

Direct impacts of the build alternatives would be similar to the impacts on the Sitka black-tailed deer because deer comprise 80 percent of the diet of the wolf on Gravina Island. All project alternatives could impact Sitka black-tailed deer, and therefore could affect the wolf by reducing its primary prey. Collisions with cars on the new road would also be a potential direct impact on wolves.

4.15.7.3 Black Bear

No Action Alternative

There would be no effect on black bears as a result of the No Action Alternative.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

Direct impacts on black bears would mainly consist of direct habitat loss within the footprint of the road and displacement of bears from habitat adjacent to the road due to increased human disturbance.

4.16 FLOODPLAIN IMPACTS

4.16.1 No Action Alternative

The No Action Alternative would have no effect on floodplains in the project area.

4.16.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), and F3

All bridge alternatives would avoid impacts to mapped riverine floodplains within the Borough. No work would be performed in active floodplains, which could result in a change to the base flood elevation in areas with known base flood elevations. However, all bridge alternatives would require construction within the coastal flood zone (Zone A) associated with Tongass Narrows. Base flood elevations for the Zone A coastal flood zone have not been established. Any structures in the coastal flood zone would not alter or increase the risk of flooding. No impacts to the natural hydraulics of Tongass Narrows, including tides and flooding are expected to result from development of one of the bridge alternatives. Sections 4.14.1 (Wetlands), 4.15.1 (Water Bodies), 4.15.3 (Marine Habitat), and 4.15.4 (Wildlife-Aquatic Species) describe the potential effects of bridge pier placement on natural resources in the floodplain and intertidal areas. Impacts on natural and beneficial floodplain values would occur only in the area of the bridge pier footprint, as described in those sections. The natural and beneficial floodplain values associated with all of Tongass Narrows would not be affected by development of a bridge alternative.

4.16.3 Alternatives G2, G3, and G4

All ferry alternatives would avoid impacts to mapped riverine floodplains within the Borough. Ferry terminals necessarily would be placed at the shoreline, which is influenced by tides as well as flooding. No work will be performed in active floodplains, which could result in a change to the base flood elevation in areas with known base flood elevations. However, all ferry terminal facilities would require construction within the coastal flood zone (Zone A) associated with Tongass Narrows. Base flood elevations for the Zone A coastal flood zone have not been established. Any structures in the coastal flood zone would not alter or increase the risk of flooding. No impacts to the natural hydraulics of Tongass Narrows, including tides and flooding are expected to result from development of one of the ferry alternatives. Sections 4.14.1 (Wetlands), 4.15.1 (Water Bodies), 4.15.3 (Marine Habitat), and 4.15.4 (Wildlife-Aquatic Species) describe the potential effects of ferry terminal development on the shoreline on natural resources in the floodplain and intertidal areas. Impacts on natural and beneficial floodplain values would occur only in the area of the ferry terminal footprint, as described in those sections. The natural and beneficial floodplain values associated with all of Tongass Narrows would not be affected by development of a ferry alternative.

4.17 WILD AND SCENIC RIVERS

There are no national or state-designated wild or scenic rivers in the project area; therefore, no impacts to these resources would result from this project.

4.18 COASTAL BARRIERS

There are no coastal barriers in the project area; therefore, no impacts to these resources would result from this project.

4.19 COASTAL ZONE IMPACTS

4.19.1 No Action Alternative

The No Action Alternative would have no adverse effect on coastal zone management.

4.19.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

All build alternatives fall within Alaska's coastal zone and are subject to consistency review under the ACMP and the Borough Coastal Management Plan.²⁸

The ACMP requires that each project in Alaska's coastal zone be reviewed by coastal resource management professionals and be found consistent with the statewide standards of the ACMP and the enforceable policies of the project's coastal district. A finding of consistency with the ACMP must be obtained before permits can be issued for the project. The Borough Coastal Management Plan was adopted in 1984 and is in the process of being updated as part of *Ketchikan 2020*.

Because the planning activity for *Ketchikan 2020* is being closely coordinated with the Gravina Access Project (see Section 3.1.2.4), all build alternatives are consistent with the policies of the Borough Coastal Management Plan. Design details of the selected alternative will be reviewed and possibly modified to be consistent with specific ACMP standards.

4.20 THREATENED AND ENDANGERED SPECIES

4.20.1 Steller Sea Lions

4.20.1.1 No Action Alternative

There would be no new impacts to Steller sea lions under the No Action Alternative.

4.20.1.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

All build alternatives may result in some impacts to Steller sea lions in Tongass Narrows. A June 4, 2001 letter from NOAA Fisheries provides the response to the request for informal consultation in accordance with Section 7 of the Endangered Species Act (Appendix R). The principal direct impacts could include the minor loss and alteration of marine habitat, minor disturbances from increased noise levels, minor loss of food sources and cover, and temporary and/or permanent displacement. The habitat and population of sea lion prey, principally off-bottom fish, is not expected to be substantially affected. Sea lions could be exposed to increased noise from project operation (vehicles driving on the bridge and ferry engines). Based on the NOAA Fisheries letter and other research, impacts are not expected to produce population-level effects that are distinguishable from natural variation in numbers and no adverse impacts are anticipated. NOAA Fisheries specifically stated in the June 4, 2001 letter "Steller sea lions are unlikely to be affected by underwater noise associated with project construction activities because they have higher thresholds for noise disturbance and are able

²⁸Ketchikan Gateway Borough, *Coastal Management Plan*.

to raise their heads out of the water to avoid noise transmission.” Direct impacts could also involve collisions between sea lions and ferries; however, this is not likely because marine mammals in general tend to avoid collisions by using their excellent acoustic capabilities. Section 4.25 (Construction Impacts) provides a discussion of impacts of noise during project construction on the Steller sea lion and potential mitigation.

4.20.2 Humpback Whales

4.20.2.1 No Action Alternative

Movements of humpback whales would continue to be slightly altered by ferry operations associated with the No Action Alternative.

4.20.2.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

All build alternatives may result in some impacts to humpback whales in Tongass Narrows. Impacts are not expected to produce population-level effects that are distinguishable from natural variation in numbers. The principal direct impacts could include disturbance from increased noise levels and temporary and/or permanent displacement. Whales could be exposed to increased noise from project operation (vehicles driving on the bridge and ferry engines); however, they would likely move away from areas of excessive noise and disturbance. Humpback whales could be displaced by ferry traffic as they traverse, rest, and feed in Tongass Narrows. However, they do not stay in Tongass Narrows for extended periods of time; therefore, these disturbances are not expected to have a measurable impact on humpback whales. Section 4.25 (Construction Impacts) provides a discussion of impacts of noise during project construction on the humpback whale. A June 4, 2001 letter from NOAA Fisheries provides the response to the request for informal consultation in accordance with Section 7 of the Endangered Species Act (Appendix R).

4.21 HISTORICAL AND ARCHEOLOGICAL PRESERVATION

Under Section 106 of the National Historic Preservation Act,²⁹ any impact, direct or indirect, "that alters any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity location, design, setting, materials, workmanship, feeling, or association" of the property is an adverse effect.

Because the build alternatives under consideration consist of several corridors, a phased process is being used to conduct identification and evaluation efforts per 36 CFR 800.4(b)(2). The likely presence of historic properties within the area of potential effect for each alternative has been established through background research, consultation, an appropriate level of field investigation, and determinations of eligibility. The level of effort, to date, has been commensurate with the number of alternatives under consideration, the likely effects of the undertaking, and the views of the SHPO. At the time of fieldwork conducted as late as August 2002, there was no preferred alternative (Alternative F1 was identified as the preferred alternative in January 2003).

²⁹ National Historic Preservation Act, as amended (Executive Order 11593; 23 CFR 771; 36 CFR 60, 63, and 800).

DOT&PF has submitted a finding by FHWA and DOT&PF of “no historic properties affected” for the project to the SHPO for concurrence. The following paragraphs consider those cultural sites noted in Chapter 3 that are within the Area of Potential Effects (APE) for the alternatives (see Section 3.21.2). Indirect effects on archeological and historic resources could result from improving access to areas that may include archeological and historic resource sites. These impacts are described in Section 4.26 (Secondary Impacts).

4.21.1 No Action Alternative

The No Action Alternative would have no effect on cultural resources.

4.21.1.1 Alternatives C3(a), C3(b), C4, D1, G1, G3, and G4

There are no known or suspected historic or archeological resources within the APE for Alternatives C3(a), C3(b), C4, D1, G1, G3, or G4. Therefore, there would be no impact on Section 106 resources under these alternatives. Should any of these alternatives later be selected as the preferred alternative, an intensive survey would be undertaken.

4.21.1.2 Alternative F1 (Preferred)

FHWA and DOT&PF have determined the craftsman house (KET-776) not eligible for the National Register. The historic dumpsite, KET-435, is also within the APE for visual effects but not physical effects. Because of the nature of this site as a dumpsite, visual impacts are not an issue, and this site was not considered further.

The buildings found on the eastern side of Pennock Island during the field reconnaissance for this project (KET-774) are within the APE of Alternative F1 for physical impacts. The determination of eligibility performed for this project indicated that these cabins are significant under National Register Criterion D (information potential) and therefore eligible for the National Register.

On Gravina Island, at and near the touchdown of the Alternative F1 West Channel bridge, are the remains of a large barge, a cabin, and large engine. There is also a “boat way” cleared through the rocks on the beach in front of the cabin. These comprise KET-775. The forest along the shore is dotted with cut stumps and at least one culturally modified tree (CMT). The FHWA and DOT&PF determination of eligibility for this project found KET-775 eligible for the National Register under Criterion D (information potential).

A house, shed, and chicken coop site lies within the APE for visual effects but outside the APE for physical effects. The site was not located in the field, and it was confirmed that this site is outside the APE for direct, physical effects. Based on examination of aerial photographs and investigation along the beach, it is assumed that the site, if it exists, could be important only for its information potential and is not subject to visual effects.

Based on the FHWA and DOT&PF determination, and in accordance with 36 CFR 800.4(a) and (c), none of these sites would be affected. The Alternative F1 bridge would be overhead at the KET-774 and KET-775 sites. A commitment of project design is that the KET-774 and KET-775 sites would be avoided by construction activity, and the design would ensure that all bridge pilings were located to avoid any effect to these sites. The boundaries of these sites will be investigated and marked in the field prior to final design. The other sites are within the APE for

visual effects only, and, because of their eligibility under Criterion D, none are subject to visual effects. If further consultation between FHWA and SHPO deem it necessary, a more intensive field survey for subsurface archeological resources within the construction footprint will be conducted for the preferred alternative before the Final EIS.

4.21.1.3 Alternative F3

KET-435, the historic dumpsite, is within the Alternative F3 APE for visual effects but not physical effects. Because of the nature of the site as a dumpsite, visual impacts are not an issue, and this site was not considered further.

The buildings found on the eastern side of Pennock Island during the field reconnaissance for this project (KET-774) are within the APE of Alternative F3 for visual effects but not physical impacts. The FHWA and DOT&PF determination of eligibility performed for this project indicated that these cabins are significant under National Register Criterion D (information potential) and therefore are eligible for the National Register. Because of the nature of the site, being significant for Criterion D only, it is not subject to visual effects.

On Gravina Island are the remains of a large barge, a cabin, and large engine south of the Alternative F3 bridge alignment. There is also a “boat way” cleared through the rocks on the beach in front of the cabin. These comprise KET-775. This site is outside the F3 APE for physical effects but within the APE for visual effects. The FHWA and DOT&PF determination of eligibility for this project found KET-775 eligible for the National Register under Criterion D (information potential).

A house, shed, and chicken coop site lies within the APE for visual effects but outside the APE for physical effects. The site was not located in the field, and it was confirmed that this site is outside the APE for direct, physical effects. Based on examination of aerial photographs and investigation along the beach, it is assumed that the site, if it exists, could be important only for its information potential and is not subject to visual effects.

Based on a FHWA and DOT&PF determination, and in accordance with 36 CFR 800.4A, none of these sites would be affected. All are within the APE for visual effects only, and none are subject to visual effects.

4.22 HAZARDOUS WASTE SITES

A preliminary analysis of hazardous waste sites that could affect project development was conducted for each of the project alternatives based on database searches and site reconnaissance. Appendix P provides a detailed description of hazardous waste sites identified in the analysis that could affect the project alternatives.

4.22.1 Known Sites

4.22.1.1 No Action Alternative

No known hazardous waste site would be affected by the No Action Alternative.

4.22.1.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

Four known hazardous waste sites were identified in the preliminary hazardous waste sites investigation as being near the construction right-of-way of one or more build alternatives: the USCG Station and Ketchikan Tank Farm near Alternative F1, Bailey Power Plant near Alternative G4, and a leaking underground storage tank (LUST) at the airport (see Table 3-24). For all build alternatives, the location and extent of the release from the LUST at the airport should be determined prior to construction. Further investigation would include a Phase I Hazardous Waste Site Investigation in accordance with guidelines of the American Society for Testing and Materials (ASTM E1527-00, 2000), which would include interviews with property owners, a review of historical documents, regulatory agency consultation, and complete site inspection. The Phase 1 investigation at the airport should include a review of all tenant operations involving hazardous materials; i.e., the RCRA permitted sites operated by Alaska Airlines, Taquan Air Service, Petro Marine Services, and Pro Mech (see Table 3-23). The investigation would characterize hazardous materials transport, storage, use, and disposal practices and identify potential releases of hazardous wastes.

None of the other known hazardous waste sites identified in the analysis (see in Section 3.22) are within the construction right-of-way. Although the three contaminated areas at the USCG Station are close to Alternative F1, the contaminants are downgradient from the alignment or the alignment is outside of the migratory pathway of the contaminants. Therefore, the known hazardous waste releases at the USCG Station would not affect development of Alternative F1. The Ketchikan Tank Farm, also close to Alternative F1, is downgradient from any construction areas associated with Alternative F1 and therefore not a concern for development of that alternative. Similarly, the Bailey Power Plant would not affect Alternative G4 because migration pathways from the site do not intersect the proposed Alternative G4 ferry terminal.

4.22.2 Potential Sites

The following paragraphs identify properties where, based on visual inspection and database review, further investigation is recommended to determine whether hazardous wastes are present. Sites recommended for further study would be subject to a Phase I Hazardous Waste Site Investigation in accordance with guidelines of the American Society for Testing and Materials (ASTM E1527-00, 2000) and would include interviews with property owners, a review of historical documents, regulatory agency consultation, and site inspection. The recommendation for future study is made if the property would be acquired for construction of the selected alternative. If a release of hazardous materials is identified during the Phase I investigation, a sampling plan would be developed to determine the extent of the release and establish an approach to site remediation. Contaminated sites identified during the Phase I investigations would be remediated prior to construction to eliminate the human health hazard.

If unknown hazardous materials were encountered during construction, construction contractors would be required to meet all federal, state, and local regulatory requirements regarding the discovery and use of hazardous materials. These regulatory requirements include worker right-to-know and safety training for the discovery and use of hazardous materials. Construction contractors on site must be trained to meet federal, state, and local regulatory requirements in recognizing and reporting discovery of unknown contamination, and proper use and handling of hazardous materials during construction. The contractor would be expected to isolate the area and prevent migration of any contaminants.

4.22.2.1 No Action Alternative

The No Action Alternative would not involve any property acquisition or construction activity; therefore, this alternative would have no effect on the potential hazardous waste sites in the project area.

4.22.2.2 Alternative C3(a) and C3(b)

At the intersection of Tongass Avenue and Signal Road, the proposed alignments would be located directly north of a car dealership. Construction right-of-way would be required within the car dealership property. Previous use of this property may have involved the use of hazardous materials and/or the generation of hazardous wastes. Current practices at the car dealership (e.g., vehicle maintenance and repair) could have resulted in the release of hazardous wastes (e.g., solvents, used oil, battery fluids) to the environment. If Alternative C3(a) or C3(b) were selected, a Phase I investigation of the car dealership property should be conducted to characterize the hazardous waste potential of the site.

4.22.2.3 Alternatives C4 and D1

Alternatives C4 and D1 would traverse the Ketchikan Ready-Mix and Quarry. A construction staging area with construction waste (e.g., rusted metal, lumber, and 55-gallon drums) is located adjacent to the alignment of Alternative C4 and within the alignment of Alternative D1. If Alternative C4 or D1 were selected, a Phase I investigation is recommended to determine whether hazardous wastes have been released at the quarry site and associated construction staging area.

The South Coast Inc. property located on Tongass Avenue near the Alternative C4 bridge crossing (see Figure 3.18) has a RCRA permit. The EPA database³⁰ indicates there are no compliance issues associated with the site; however, there are no reported inspections of the site with respect to permit compliance. Further investigation of the site (i.e., Phase I) should be conducted if Alternative C4 were selected.

4.22.2.4 Alternative F1 (Preferred)

If Alternative F1 were selected, further investigation of potential hazardous wastes should be conducted at the USCG property. Although the known contaminated sites at the USCG facility are undergoing an active cleanup program and are downgradient from the Alternative F1 alignment, a Phase I investigation of the area of the USCG property to be traversed by the alternative should be completed if Alternative F1 were selected.

The Ketchikan City Landfill, a RCRA permitted site, is also a potential source of contamination for Alternative F1. The EPA database³¹ indicates there are no compliance issues associated with the site; however, there are no reported inspections of the site with respect to permit compliance. Because it is located upgradient from the proposed Alternative F1 alignment, further investigation (i.e., Phase I) of this facility should be conducted to ensure that there are no contaminants migrating offsite into the area proposed for construction of Alternative F1, if this alternative were selected.

³⁰ EPA Region 10, Enforcement and Compliance On Line Database: <http://yosemite.epa.gov/R10/ENFORCE.NSF/webpage/EC-On-Line>

³¹ EPA Region 10, Enforcement and Compliance On Line Database: <http://yosemite.epa.gov/R10/ENFORCE.NSF/webpage/EC-On-Line>

4.22.2.5 Alternative F3

None of the properties traversed by this alignment, other than the airport (see Section 4.22.1.2), indicate the potential of hazardous wastes.

4.22.2.6 Alternative G2

Alternative G2 would involve construction of a ferry terminal and parking facilities on Peninsula Point in the vicinity of the Pro Mech aircraft hangar and the Temsco Helicopter site and other developed lands. Past and current aircraft maintenance activities at the hangar likely involve the use of hazardous materials and disposal of hazardous wastes, some of which may have been released to the environment. If Alternative G2 were selected, a Phase I investigation of the Pro Mech hangar should be conducted to determine whether hazardous wastes have been released from the site. Other previously disturbed (cleared and filled) areas on Peninsula Point would be included in the investigation.

4.22.2.7 Alternative G3

The site of the proposed ferry terminal on Revillagigedo Island is in a commercial area of downtown Ketchikan that could have been used for activities that involved the use of hazardous materials or the generation and disposal of hazardous wastes. If Alternative G3 were selected, a Phase I investigation of this site would be required to determine whether past uses of the site could have resulted in the release of hazardous wastes to the environment.

4.22.2.8 Alternative G4

The site of the proposed ferry terminal adjacent to the existing airport ferry terminal could have been used for activities that used hazardous materials and/or generated and disposed of hazardous wastes. If Alternative G4 were selected, a Phase I investigation of this site would be required to determine whether past uses of the site could have resulted in the release of hazardous wastes to the environment.

4.23 VISUAL IMPACTS

Visual impacts of each project alternative were identified relative to the key views described in Section 3.23 (Visual Environment). The photographs in this section show a simulation of each of the project alternatives superimposed on key views in the project area. The assessment of the impacts of the alternatives, in the form of visual changes to the existing environment, is based largely on these visual simulations.

Aesthetics and scenic qualities of an area—and project-related impacts on those resources—are subjective and based on the interests and values of the viewers. For this EIS, an impact on visual quality is classified as “adverse” if a substantial new visual element is introduced into a predominantly undeveloped existing view, or if a new visual element would substantially change an existing view (such as the introduction of a major new structure in a landscape or view featuring urban development).

In general, each of the bridge alternatives would introduce a major new visual element into key views by adding a large structure across Tongass Narrows and adding roadways and/or

structures to Revillagigedo and Gravina Islands, and, for Alternatives F1 and F3, Penneck Island. The ferry alternatives would add a minor new visual element to several key views in the form of added shoreline development and roadways to support ferry operations. None of the build alternatives would result in removal of existing substantial structures that contribute to the visual environment.

Construction activities associated with the build alternatives would have an adverse impact on the visual environment due to land clearing and the presence of construction equipment. These impacts are addressed in Section 4.25.

All build alternatives except Alternative G4 would provide new views of the landscape and Tongass Narrows for vehicles, pedestrians, and bicyclists using the new crossing.

If a build alternative were selected, design quality, art, and architecture would be taken into consideration during final project design and planning. The Alaska State Council on the Arts and the Ketchikan Area Arts and Humanities Council would be consulted during the final design phase if a build alternative were selected. Both entities are on the distribution list of this EIS and invited to comment.

4.23.1 No Action

The No Action Alternative would have no impacts on the visual environment in the project area.

4.23.2 Alternative C3(a)

Alternative C3(a) would introduce a major new visual element to the project area—a high bridge across Tongass Narrows—and would have an adverse effect on the scenic quality of the views from the Ketchikan area. The bridge would be visible from several key viewpoints: the cruise ship dock downtown, Bar Harbor, Knob Hill, the AMHS passenger terminal (Key Views 3A, 12, 5, 6, and 10A, respectively, in Section 3.23.4), and Tongass Avenue (Key View 11 shown below). Views toward Tongass Narrows and Gravina Island from these locations would be partially obstructed by the presence of the bridge. In addition, this alternative would involve a roadway and structure from its terminus at Signal Road north of downtown Ketchikan that would proceed along the hillside toward the southwest. This roadway and structure would have an adverse impact on the visual environment.



Alternative C3(a) bridge from north of Wolf Point on Tongass Avenue, looking south.

4.23.3 Alternative C3(b)

Alternative C3(b) would have similar impacts on the visual environment as Alternative C3(a), and would be visible from the same key views: the cruise ship dock downtown, Bar Harbor, Knob Hill, the AMHS passenger terminal (Key Views 3A, 12, 5, 6, and 10A, respectively, in Section 3.23.4), and Tongass Avenue (Key View 11 shown below). Views toward Tongass Narrows and Gravina Island from these locations would be partially obstructed by the presence of the bridge. Although the bridge structure is lower (by approximately 80 feet) than that of Alternative C3(a), the bridge still introduces a major new structural element to the visual environment. Alternative C3(b) would have an adverse impact on visual quality of the project area.



Alternative C3(b) bridge from north of Wolf Point on Tongass Avenue, looking south.

4.23.4 Alternative C4

Alternative C4 would have similar impacts with respect to crossing Tongass Narrows as Alternatives C3(a) and C3(b), and would be visible from the same key views: the cruise ship dock downtown, Bar Harbor, Knob Hill, the AMHS passenger terminal (Key Views 3A, 12, 5, 6, and 10A, respectively, in Section 3.23.4), and Tongass Avenue (Key View 11 shown below). Views toward Tongass Narrows and Gravina Island from these locations would be partially obstructed by the presence of the bridge. The Ketchikan terminus for Alternative C4 would be on Tongass Avenue near the existing airport ferry terminal, and would include a roadway and structure along the hillside before it crosses Tongass Narrows. This element of the bridge alternative would have an adverse visual impact on the area around the roadway.



Alternative C4 bridge from north of Wolf Point on Tongass Avenue, looking south.

4.23.5 Alternative D1

Alternative D1 would introduce a new visual element to the project area—a bridge across Tongass Narrows. While the bridge would be 80 feet lower than those proposed for Alternatives C3(a) and C4, it would still adversely impact the visual quality of the study area and would be visible from the same key views: the cruise ship dock downtown, Bar Harbor, Knob Hill, the AMHS passenger terminal (Key Views 3A, 12, 5, 6, and 10A, respectively, in Section 3.23.4), and Tongass Avenue (Key View 11 shown below). Views toward Tongass Narrows and Gravina Island from these locations would be partially obstructed by the presence of the bridge. Also, similar to Alternative C4, the Ketchikan terminus of Alternative D1 would be Tongass Avenue near the existing airport ferry terminal, and would require construction of a roadway and structure on the hillside to the northwest of the terminus. This roadway and structure would have an adverse impact on the visual quality of the surrounding area.



Alternative D1 bridge from near Wolf Point on Tongass Avenue, looking south.

4.23.6 Alternative F1 (Preferred)

For this alternative, the East Channel bridge across Tongass Narrows would be approximately 200 feet above the water and would partially obstruct the views toward Tongass Narrows from Saxman, the USCG Station, the cruise ship docks downtown, (Key View 1, 2A, and 3 in Section 3.23.4 and Key View 2 shown below), and from upper Front Street (Key View 4, see below). Views toward Tongass Narrows and Pennock Island from these locations would be partially obstructed by the presence of the bridge.



Alternative F1 200-foot bridge over East Channel from south of the USCG Station on Tongass Avenue, looking north.



Alternative F1 200-foot bridge from the cruise ship dock (Upper Front Street), looking south.

In addition, the alternative includes a second, lower bridge (120 feet above the water) across the West Channel. Both bridges would be visible from mid-Tongass Narrows near the airport (Key View 10, see below). Because the bridges are distant from this mid-Tongass Narrows location, they present only a minor obstruction to views southward from this viewpoint.



Alternative F1 bridges and Pennock Island from mid-Tongass Narrows near the airport, looking south.

This alternative would also include a roadway on Pennock and Gravina Islands that would adversely impact the existing, generally undeveloped visual environment of these islands. In addition, Alternative F1 would require construction of a roadway and structure from the Ketchikan terminus on Tongass Avenue, up and along the hillside to the south and east of

downtown Ketchikan. This roadway and structure would have an adverse impact on the visual environment.

4.23.7 Alternative F3

For this alternative, the East Channel bridge across Tongass Narrows would be approximately 60 feet above the water and would partially obstruct the views toward Tongass Narrows from Saxman and the USCG Station (Key View 1, 2, and 2A in Section 3.23.4; Key View 2 shown below). Views toward Tongass Narrows, Pennock Island, and Gravina Island from these locations would be partially obstructed by the presence of the bridge and upper Front Street (Key View 4, see below).



Alternative F3 60' bridge over East Channel from south of the USCG Station on Tongass Avenue, looking north.

In addition, the alternative includes a second, higher bridge (200 feet above the water) across the West Channel. Both bridges would be visible from mid-Tongass Narrows near the airport (Key View 10, see below). Because the bridges are distant from this mid-Tongass Narrows location, they present only a minor obstruction to views southward from this viewpoint. This alternative would also include a roadway on Pennock and Gravina Islands that would adversely impact the existing, generally undeveloped visual environment of these islands.



Alternative F3 bridges and Pennock Island from mid-Tongass Narrows near the airport, looking south.

4.23.8 Alternative G2

Ferry operation would not adversely impact the visual environment of Tongass Narrows. The ferry terminals for this alternative would include new parking areas and a roadway from Lewis Point to the airport. The proposed ferry terminal on Gravina Island would adversely impact the visual environment by introducing a new built element into a generally undeveloped area.



Alternative G2 ferry from Gravina Island shoreline near the northern end of the airport runway, looking north.

4.23.9 Alternative G3

The ferry terminal facilities in Ketchikan would involve redevelopment of an area with existing urban development and would not impact the visual quality of the terminal area. This alternative would adversely impact the visual environment associated with the addition of a ferry terminal and roadway on Gravina Island.



Alternative G3 ferry from the north parking area adjacent to Plaza Port West, looking northwest toward Gravina Island.

4.23.10 *Alternative G4*

Alternative G4 would expand the existing ferry terminal facilities in Ketchikan and involve development of an access roadway in the vicinity of the airport. This alternative would not impact the visual environment of the study area, since it would not introduce substantial new visual elements into the landscape. It would not provide new viewing opportunities.

4.24 ENERGY

The transportation systems included in this analysis rely on energy consumption for their function and mobility. Other than transportation and construction activities associated with the build alternatives, there are no actions associated with the Gravina Access Project that would require energy consumption. The availability of energy in the form of fuel (petroleum products) for motor vehicles, cruise ships, and ferry vessels would not change as a result of the Gravina Access Project alternatives. Fuel consumption would change as a result of changes in travel patterns associated with any of the project's build alternatives.

4.25 CONSTRUCTION IMPACTS

Construction impacts are the temporary impacts on environmental resources in the project area that are caused by the actual activities associated with the construction of the project. These impacts are examined separately from the permanent impacts of a project from its ongoing existence and operation.

The major potential construction activities considered in the evaluation of construction impacts in this Section 4.25 for all build alternatives are:

- ◆ Preparing foundation for bridge piers and abutments (all build alternatives include some bridge construction)
- ◆ Pile driving
- ◆ Demolishing structures and disposing of debris

- ◆ Mining borrow material (for aggregate fill)
- ◆ Material waste disposal and construction equipment staging
- ◆ Preparing foundations (grading, filling, and compacting)
- ◆ Constructing roadways
- ◆ Temporarily rerouting traffic at existing road links
- ◆ Temporary navigational restrictions

In addition, Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), and F3 would include the following construction activities:

- ◆ Drilling through rock and sediment
- ◆ Channel excavation
- ◆ Erection of shoring and falsework
- ◆ Installing piers and abutments
- ◆ Constructing bridge(s) and bridge approaches

The ferry terminal and facilities associated with Alternatives G2, G3, and G4 would include the following construction activities:

- ◆ Constructing ferry terminals
- ◆ Constructing parking lots, passenger facilities, and docks

The following sections describe the impacts of construction of the Gravina Access Project alternatives on the project area. There would be no construction impacts associated with the No Action Alternative; therefore, that alternative is omitted from this discussion.

4.25.1 Land Use

For all build alternatives, the existing land use of some parcels could be changed temporarily to stage construction equipment and supplies. The locations of staging areas for each alternative have not been determined; therefore, specific parcels potentially affected by construction staging are not yet known. It is expected that Gravina Island and vacant land on existing construction yards would be used for staging areas where possible in order to minimize disruption of businesses, residences, and the community. Any land affected during construction would be restored to approximate original condition after the completion of construction.

4.25.1.1 Alternatives C3(a) and C3(b)

The bank and car dealership at the intersection of Tongass Avenue with Signal Road would be affected by construction. The existing use of these properties during construction would be disrupted by the movement of vehicles and equipment adjacent to and across portions of these properties. Movement of construction equipment adjacent to these properties would constrain access. The movement of construction vehicles and equipment would also disrupt some residential properties along Baker Street North and Bucey Avenue North; however, access to these properties would not be impeded.

On Gravina Island, the movement of construction vehicles and equipment would affect use of open space areas along the alignment for subsistence activity, recreation, and hunting. These effects would be limited to a small corridor immediately adjacent to the construction activity.

Mitigation

The DOT&PF would work with the businesses and local residents to maintain property access throughout the construction phase, using signs, temporary entrances, and traffic controls, as appropriate. Construction easements would be selected in a fashion that minimizes disturbance and properties and land uses would be returned to preconstruction conditions to the maximum extent practicable. Construction limits would be staked and clearly demarcated to prevent encroachment into adjacent areas.

4.25.1.2 Alternative C4 and D1

The Ketchikan Ready-Mix quarry would be affected by construction. The existing use of this property during construction would be disrupted by the movement of vehicles and equipment adjacent to and across the property. Movement of construction equipment adjacent to the property would constrain access. On Gravina Island, the movement of construction vehicles and equipment would affect use of open space areas along the alignment for subsistence activity, recreation, and hunting. These effects would be limited to a small corridor immediately adjacent to the construction activity.

Mitigation

The DOT&PF would work with the Ketchikan Ready-Mix quarry to maintain property access throughout construction, using signs, temporary entrances, and traffic controls, as appropriate. Construction easements would be selected in a fashion to minimize disturbance and properties and land uses would be returned to preconstruction conditions to the maximum extent practicable. Construction limits would be staked and have clear demarcation lines to prevent encroachment into adjacent areas.

4.25.1.3 Alternative F1 (Preferred)

Alternative F1 would affect the R&S Construction quarry, potentially affecting access to portions of the southern end of the site. Beyond the R&S Construction quarry, Alternative F1 would affect an area currently used, somewhat informally, for old construction equipment storage. Storage of the equipment would have to move to another site. Alternative F1 would cross the USCG Station property; however, construction activities would occur in a portion of the property not currently used by the USCG for its operations or training. Alternative F1 is not expected to affect existing developed land use on Revillagigedo Island. On Gravina and Pennock Islands, the movement of construction vehicles and equipment would affect use of open space areas along the alignment for subsistence activity, recreation, and hunting. These effects would be limited to a small corridor immediately adjacent to the construction activity.

Mitigation

Construction staging and movement would be constrained within construction easements. Activities within the USCG Station property would be closely coordinated with USCG officials. Construction limits would be staked and clearly demarcated to prevent encroachment into adjacent areas.

4.25.1.4 Alternative F3

No land uses on Revillagigedo Island would be directly affected by construction vehicles and equipment. On Gravina and Pennock Islands, the movement of construction vehicles and equipment would affect use of open space areas along the alignment for subsistence activity, recreation, and hunting. These effects would be limited to a small corridor immediately adjacent to the construction activity.

Mitigation

Construction staging and movement would be constrained within construction easements. Construction limits would be staked and clearly demarcated to prevent encroachment into adjacent areas.

4.25.1.5 Alternative G2

Commercial properties along the Peninsula Point access road would be affected by construction. Use of these properties during construction would be disrupted by the movement of vehicles and equipment adjacent to and across the properties. Movement of construction equipment adjacent to the properties would constrain access.

On Gravina Island, the movement of construction vehicles and equipment would affect use of open space areas along the alignment for subsistence activity, recreation, and hunting. These effects would be limited to a small corridor immediately adjacent to the construction activity.

Mitigation

DOT&PF would work with the commercial properties near Peninsula Point to maintain property access throughout construction, using signs, temporary entrances, and traffic controls, as appropriate. Construction easements would be selected in a fashion that minimizes disturbance, and properties and land uses would be returned to preconstruction conditions to the maximum extent practicable. Construction limits would be staked and clearly demarcated to prevent encroachment into adjacent areas.

4.25.1.6 Alternative G3 and G4

No land uses on Revillagigedo Island would be affected by movement of construction vehicles and equipment. On Gravina Island, the movement of construction vehicles and equipment would affect use of open space areas along the alignment for subsistence activity, recreation, and hunting. These effects would be limited to a small corridor immediately adjacent to the construction activity.

Mitigation

Construction easements would be selected in a fashion that minimizes disturbance. Construction limits would be staked and clearly demarcated to prevent encroachment into adjacent areas.

4.25.2 Social Environment

4.25.2.1 Population and Social Groups

None of the build alternatives would have an adverse construction impact on the size or composition of the general population, or on any distinct population group (i.e., minority, low-income, elderly, or handicapped).

4.25.2.2 Neighborhoods and Community Cohesion

Construction would have temporary and intermittent adverse impacts on travel patterns in neighborhoods near the build alternatives. Construction activities would be disruptive to normal activities in these neighborhoods because of the noise, vibration, and traffic that would be introduced to these areas. Depending on the alternative, traffic might have to be diverted during construction, and travel patterns and community access might have to be altered to accommodate construction activities and heavy equipment. Noise and vibration impacts are specifically addressed in Section 4.25.9. Traffic impacts are specifically addressed in Section 4.25.5.3.

4.25.2.3 Community and Public Safety Facilities

Construction of the build alternatives would not affect schools, medical facilities, fire stations, and the provision of public safety services in the Borough. Vehicular access to all community and public safety facilities and would be maintained throughout construction.

Construction of any of the build alternatives would adversely affect traffic on Tongass Avenue near the alternative's intersection with and/or crossing of Tongass Avenue and at the airport, which could result in delays for emergency vehicles, depending on the location of the emergency and the routes available. Traffic impacts are specifically addressed in Section 4.25.5.3.

4.25.2.4 Recreation

Construction of the build alternatives would not affect the use of parks, trails, playing fields, recreation areas and centers, and tennis courts in Ketchikan. Construction could affect fishing, hunting, hiking, and bicycling activities that might otherwise occur within or immediately adjacent to construction areas on Revillagigedo, Gravina, and Pennock Islands.

Recreational boating in Tongass Narrows would be prohibited in the immediate in-water and shorefront construction zones of the project build alternatives. However, the overall opportunity for such recreation activities would not be affected during construction.

Similarly, recreational fishing, hunting, hiking, and bicycling on Revillagigedo, Gravina, and Pennock Islands would be prohibited in construction zones. However, the overall opportunity for such recreation activities would not be affected during construction.

4.25.2.5 Accessibility

Under all build alternatives, access to properties in and near construction zones could be altered by construction activities. The DOT&PF would work with the businesses and local

residents to maintain property access throughout the construction phase, using signs, temporary entrances, and traffic controls, as appropriate. Construction easements would be selected in a fashion that minimizes disturbance and properties and land uses would be returned to preconstruction conditions to the maximum extent practicable. Construction limits would be staked and clearly demarcated to prevent encroachment into adjacent areas. These efforts would

4.25.3 Relocation Impacts

Project construction activities would not require any temporary relocation of homes or businesses.

4.25.4 Economy and Economic Resources

4.25.4.1 Construction Spending

Construction spending associated with any build alternative would directly benefit the Ketchikan economy. The spending discussed here is spending that is spent within the Borough and does not include any indirect or multiplier effects of the spending in the local area. These indirect effects (including the economic development that results because of improved access) are discussed in Section 4.26. The estimates of construction spending expected to occur within Borough are shown in Table 4-13. Alternative F1 (Preferred) has the highest total local construction spending (\$56.6 million) and Alternative G4 has the lowest (\$30.9 million).

TABLE 4-13
ESTIMATED LOCAL CONSTRUCTION SPENDING IN THE KETCHIKAN GATEWAY BOROUGH

<i>Build Alternative</i>	<i>Construction Spending (Millions of 2003\$)</i>			
	<i>Materials</i>	<i>Labor</i>	<i>Equipment</i>	<i>Total</i>
C3(a)	7.1	24.5	10.7	42.3
C3(b)	6.5	20.6	9.0	36.0
C4	6.9	26.2	14.8	47.9
D1	5.3	18.6	11.6	35.4
F1	12.4	30.0	14.2	56.6
F3'	\$11.6	\$33.2	\$14.4	\$59.2
G2	\$4.8	\$20.3	\$7.1	\$32.1
G3	\$5.2	\$21.5	\$7.8	\$34.6
G4	\$4.5	\$20.3	\$7.2	\$31.9

*Assumes channel modification would be required.

4.25.4.2 Acquisition and Relocation

The money spent on the acquisition of property would benefit the Ketchikan economy although the amount of private land, and associated property tax revenues, within the Borough and the City of Ketchikan would decrease as the rights-of-way are converted to public lands. However, it is expected that property values on Gravina Island would increase with improved access and infrastructure and therefore property taxes assessed on those lands would increase (see Section 4.26.3). Assessment of the acquisition and relocation effects is based on acquisition of

rights-of-way for the proposed routes. A summary of the cost of land and buildings that would need to be acquired is shown in Table 4-14.

**TABLE 4-14
ESTIMATED ACQUISITION COSTS**

<i>Project Alternative</i>	<i>Amount of Land Acquired (Square Feet)</i>	<i>Tax Assessor's Database/Unmodified Acquisition Value (\$2003)</i>	<i>Market Value (\$2003)¹</i>
No Action	0	0	0
C3(a)	2,012,990	553,936	587,172
C3(b)	1,977,512	802,752	850,917
C4	1,434,536	1,495,428	1,585,154
D1	1,756,764	227,731	241,395
F1	3,694,329	533,048	565,031
F3	3,182,232	47,326	50,166
G2	1,913,844	958,800	1,016,328
G3	1,099,626	3,905,953	4,140,310
G4	1,591,875	397,867	421,739

¹ Market Value equals 1.066 X the Unmodified Acquisition Value

The estimated acquisition costs in Table 4-14 include the cost of land and buildings that would need to be acquired for right-of-way under each alternative.³² Most public lands (State and Borough) are assumed to be available at no cost to the project; this assumption applies to all airport land needed for the project, including the airport floatplane facility.³³ Mental Health Trust Authority lands would have to be purchased. All property owners would be compensated in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 as amended.³⁴

4.25.4.3 Employment

Construction of any of the Gravina Access Project build alternatives would have a positive economic impact on employment. Construction of the project would require roughly 80 to 160 additional workers annually (i.e., over a 3-year construction period) from the Ketchikan labor force, depending on the build alternative chosen (see Table 4-15). While these jobs would be

³² To determine private land values, the fraction of each parcel of land to be acquired for the right-of-way is multiplied by the assessed value of the unimproved land. Once the land value is determined, maps of the rights-of-way are consulted to determine if structures would be affected by the rights-of-way. The values of any affected structure is then added to the land value. For property with structures within a right-of-way, it is always assumed either none or all of the structure would be acquired. In cases where the right-of-way acquisition would take a large portion of the parcel, an attempt is made to determine whether the remaining section(s) has usefulness to the original owner. If the remaining portion is determined to not be useful to the owner, then it is assumed that DOT&PF would acquire the entire property.

³³ The value of the public lands is included in benefit-cost analyses in consideration of the opportunity cost for using the lands for transportation instead of some other use.

³⁴ The Uniform Relocation Assistance and Real Property Acquisition Policies Act ensures the fair and equitable treatment of persons whose real property would be acquired or who would be displaced as a result of a Federal or Federally-assisted project. Government-wide regulations provide procedural and other requirements (appraisals, payment of fair market value, notice to owners, etc.) in the acquisition of real property and provide for relocation payments and advisory assistance in the relocation of persons and businesses.

filled by local Ketchikan residents, many jobs would require skilled specialists to be brought in from outside of the Ketchikan area.

**TABLE 4-15
ESTIMATED CONSTRUCTION JOBS IN THE
KETCHIKAN GATEWAY BOROUGH**

<i>Alternative</i>	<i>Total Construction Jobs</i>	<i>Annual Construction Jobs¹</i>
C3(a)	360	120
C3(b)	310	100
C4	390	130
D1	290	100
F1	470	160
F3 ²	460	150
G2 ³	250	80
G3 ³	270	90
G4 ³	250	80

¹ Annual construction jobs for bridge alternatives estimated by dividing total cumulative jobs created by a three-year construction period. The improved ferry alternatives assume a three-year initial construction period and a single year for ferry replacement and major rehabilitation in the tenth year of operation. Numbers may not calculate due to rounding.

² Assumes channel modification would be required.

³ Assumes that the new replacement ferries would be built at ASD in Ketchikan.

Construction activity would increase the need for support industries (i.e., retail, trade, etc.), which would create some additional local jobs in the retail and service sectors. This would result in additional positive economic effects for the area. The actual number of support jobs created as a result of construction would depend on which build alternative is selected, what supplies are needed for its construction, the number of construction workers, and the personal preferences of the workers (i.e., where they decide to spend their money). These secondary impacts are discussed in Section 4.26.3.

4.25.5 Transportation

4.25.5.1 Aviation

Alternatives C3(a), C3(b), C4, and D1

Fixed-wing aircraft operating from Ketchikan International Airport (with the exception of floatplanes) would not be affected during construction of Alternative C3(a), C3(b), C4, or D1. The operations of floatplanes would be affected by construction of any of these alternatives. During construction of the bridge, large cranes and other heavy equipment in the channel would interfere with floatplane operations because of the physical obstruction they would present to aircraft operating in the Tongass Narrows airspace. Approaches to and use of the airport floatplane dock could be affected during construction of any bridge alternative crossing at the airport.

The USCG helicopter pad at Wolff Point (scheduled for construction in 2004) would be within the alignment right-of-way for Alternative D1. Use of the pad for helicopter operations would not be possible during construction of this alternative. The USCG would have to resume medevac operations at Ketchikan International Airport or relocate the pad elsewhere. No other helicopter operations or facilities would be affected during construction of Alternative C3(a), C3(b), C4, or D1. The helicopter pad would no longer be needed once the bridge becomes fully operational because USCG personnel would use ground transport.

Alternative F1 (Preferred) and F3

Fixed-wing aircraft operating from Ketchikan International Airport would not be affected during construction of Alternative F1 or F3. Because the bridges associated with these alternatives are south of most floatplane facilities, including existing floatplane waterways, construction would affect few floatplane operations.

Alternatives G2, G3, and G4

The operations of fixed-wing aircraft, including floatplanes in the project area would not be affected by construction of any these alternatives.

Temco Helicopters Inc. and Alpine Helicopters Inc. operate from Peninsula Point, the site of the G2 ferry terminal. Construction of the ferry terminal on Peninsula Point could temporarily disrupt helicopter operations at these facilities, primarily due to constrained access to the site and not any restriction on actual helicopter operations.

Mitigation

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

DOT&PF would work with helicopter and floatplane operators to ensure that service disruption is minimized to the maximum extent practicable during the construction period. DOT&PF would provide continued access to floatplane service for floatplane customers at the airport, even if it is necessary to temporarily relocate the floatplane dock with Alternatives C3(a), C3(b), C4 and D1.

4.25.5.2 Marine Navigation

Alternatives C3(a) and C4

The Tongass Narrows main channel would remain open to marine traffic throughout most of the construction period. Mooring buoys and construction equipment would be present in Tongass Narrows around and under bridge piers and spans as the bridge is constructed. During bridge construction in Tongass Narrows, cruise ships and other vessels traveling through the construction area would likely decrease their speed near and adjust their routes and possibly schedules to avoid construction equipment. During bridge construction, ship passage under the bridge would be prohibited when bridge segments are being lifted from barges on the water into position on the bridge, which would occur during a 24-hour period.

Maintaining the existing ferry service between Revillagigedo Island and the airport during construction would require moving the airport ferry terminal facility to accommodate construction of the bridge structure in that area.

Alternatives C3(b) and D1

The Tongass Narrows main channel would remain open to marine traffic requiring a vertical clearance of 120 feet or lower throughout most of construction. Ships requiring a vertical clearance greater than 120 feet would permanently be routed around the west side of Gravina Island once construction of the bridge piers adjacent to the main shipping channel begins. Mooring buoys and construction equipment would be present in Tongass Narrows around and under bridge piers and spans as the bridge is constructed. During bridge construction in Tongass Narrows, vessels capable of transiting Tongass Narrows would likely decrease their speed near and adjust their routes and possibly schedules to avoid construction equipment. Ship passage under the bridge would be prohibited when bridge segments are being lifted from barges on the water into position on the bridge, which would occur during a 24-hour period.

Maintaining the existing ferry service between Revillagigedo Island and the airport during construction could require moving the Airport ferry terminal facility to accommodate construction of the bridge structure in that area.

Mitigation – Alternatives C3(a), C3(b), C4, and D1

Impacts to ships transiting Tongass Narrows would be minimized by scheduling bridge construction activity, to the extent practicable, during times of the year when the marine traffic in Tongass Narrows is low (i.e., outside of the tourist and cruise ship season). DOT&PF would work with cruise ship and other marine vessel operators in order to facilitate marine navigation during construction. Moving the existing airport ferry terminal facility would be staged so that impacts on ferry operations would be minimized and service to the airport would not be interrupted. When bridge segment placement requires limiting vessel traffic, DOT&PF would issue sufficient notification of such closures to reduce conflict with marine navigation activities.

Alternative F1 (Preferred)

The Tongass Narrows main channel would remain open to marine traffic throughout construction of Alternative F1. Construction of the bridges over the East and West Channels would limit ship passage at various phases of the construction. Vessels traveling through the East Channel during construction of that bridge would likely decrease their speed near, and adjust their routes and possibly schedules to avoid, mooring buoys and construction equipment. During East Channel bridge construction, ship passage under the bridge would be prohibited when bridge segments are being lifted from barges on the water into position on the bridge, which would occur during a 24-hour period. Once construction of the bridge piers in West Channel begins, ships requiring a vertical clearance greater than 120 feet would permanently be routed around the east side of Pennock Island. Vessels requiring 120 feet of vertical clearance or less would either move temporarily to the East Channel or likely decrease their speed near and adjust their routes and possibly schedules to avoid construction equipment in West Channel.

Alternative F3

The Tongass Narrows main channel would remain open to marine traffic throughout construction of Alternative F3. Construction of the bridges over the East and West Channels would limit ship passage at various phases of the construction. Vessels traveling through the West Channel during construction of that bridge would likely decrease their speed near, and

adjust their routes and possibly schedules to avoid, mooring buoys and construction equipment. During West Channel bridge construction, ship passage under the bridge would be prohibited when bridge segments are being lifted from barges on the water into position on the bridge, which would occur during a 24-hour period. Once construction of the bridge piers adjacent to the main shipping channel in East Channel begins, ships requiring a vertical clearance greater than 60 feet would permanently be routed around the west side of Pennock Island. Vessels requiring 60 feet of vertical clearance or less would either move temporarily to the West Channel or likely decrease their speed near, and adjust their routes and possibly schedules to avoid, construction equipment in East Channel.

Blasting and dredging in the West Channel would be required for the proposed channel modifications of the West Channel. This activity would require the placement of a working barge in the West Channel for the drilling, blasting and dredging activities. The channel modification work would be scheduled to occur prior to bridge construction in the East and West Channels, and all marine traffic would be routed through the East Channel while the channel modification work is underway. Disposal of the dredged material would require the use of tugs and tows to transport dredged materials into and out of Tongass Narrows to the disposal site, which would create additional marine traffic in the area.

Mitigation – Alternatives F1 (Preferred) and F3

For these alternatives, impacts on navigation could be minimized by constructing each bridge in a separate phase so that one of the two channels would always be unaffected by construction activities, including channel dredging with Alternative F3. DOT&PF would work with cruise ship and marine vessel operators in order to facilitate marine navigation during construction. When bridge segment placement requires limiting vessel traffic, DOT&PF would issue sufficient notification of such closures to reduce conflict with marine navigation activities.

Alternatives G2, G3, and G4

Construction of Alternatives G2, G3, and G4 would have little or no effect on marine navigation. Small boats and watercraft using nearshore areas would be diverted around construction areas. Construction areas would be relatively small and the diversion would not add to the travel time of small boats.

4.25.5.3 Vehicle Traffic

Alternatives C3(a) and C3(b)

Construction activities (i.e., vehicle and equipment movement) could temporarily disrupt traffic patterns and cause delays where these alternatives cross Tongass Avenue and at the Signal Road-Tongass Avenue intersection.

Construction in the vicinity of the airport could require temporary changes in the airport circulation road and elimination of some of the adjacent parking. The ferry terminal and approach ramp would also be relocated, which would change the traffic flow configuration. Some parking spaces may be eliminated to accommodate construction vehicles and the new ramp location.

Alternatives C4 and D1

Construction activities (i.e., vehicle and equipment movement) could temporarily disrupt traffic patterns and cause delays where these alternatives cross Tongass Avenue. Vehicle traffic to and from the Cambria neighborhood would also be adversely affected by the movement of construction vehicles on Cambria Drive and near the Cambria Drive-Tongass Avenue intersection.

Construction in the vicinity of the airport could require temporary changes in the airport circulation road and elimination of some of the adjacent parking. The ferry terminal and approach ramp could also be relocated, which would change the traffic flow configuration. Some parking spaces may be eliminated to accommodate construction vehicles and the new ramp location.

Alternative F1 (Preferred)

Construction activities (i.e., vehicle and equipment movement) could temporarily disrupt traffic patterns and cause delays on South Tongass Highway north of the Municipal Cemetery and the USCG Station where Alternative F1 intersects and crosses South Tongass Highway. Construction of the airport access road near the airport terminal could require temporary changes in the airport circulation road and elimination of some of the adjacent parking.

Alternative F3

Construction could cause traffic delays on South Tongass Highway where the alternative intersects the highway south of the USCG Station. South Tongass Highway would have to be slightly elevated to accommodate construction of Alternative F3. This could require reducing South Tongass Highway to one lane and closing the highway for short periods of time.

Construction of the airport access road near the airport terminal could require temporary changes in the airport circulation road and elimination of some of the adjacent parking.

Alternatives G2, G3, and G4

Movement of construction vehicles and equipment in and out of the ferry terminal construction sites on Revillagigedo Island could affect traffic movement along Tongass Avenue and cause delays.

Construction of the terminal for Alternative G3 would impact access, circulation, and parking in the vicinity of the Jefferson Street right-of-way north of the Plaza Mall.

Construction in the vicinity of the airport could require temporary changes in the airport circulation road and elimination of some of the adjacent parking. Some parking spaces may be eliminated to accommodate construction vehicles.

Mitigation – Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

A traffic maintenance and parking plan would be developed to minimize impacts on vehicle travel on Ketchikan roadways and at the airport. Construction of temporary roadways may be required to maintain access to the airport facilities. For Alternative F3, construction that would elevate a portion of South Tongass Highway involving road closure and restricting traffic to one lane could be done during off-peak hours to minimize the impacts on vehicular traffic. Access to the USCG Station and other affected property would be accommodated during construction through temporary driveways.

4.25.6 Pedestrians and Bicyclists

4.25.6.1 Alternatives C3(a), C3(b), C4, D1, and F1 (Preferred)

Construction activities near the airport and Tongass Avenue could temporarily disrupt pedestrian and bicycle travel patterns. Construction activities associated with Alternatives C3(a), C3(b), C4, D1, and F1 would require rerouting of pedestrians and bicyclists where the alternatives intersect and cross Tongass Avenue. Pedestrian and bicycle access would be impeded during periods of overheard construction of Tongass Avenue when temporary closures of the roads, sidewalks, or bike paths are necessary. Construction at the airport would require rerouting pedestrian pathways between the ferry terminal, airport terminal, and floatplane dock.

4.25.6.2 Alternatives F3, G2, G3, and G4

Alternatives F3, G2, G3, and G4 would temporarily disrupt pedestrian and bicycle travel patterns. Construction activities associated with Alternatives F3, G2, G3, and G4 would require rerouting of pedestrians and bicyclists where the alternatives intersect Tongass Avenue. Construction at the airport would require rerouting pedestrian and bicycle pathways between the ferry terminal, airport terminal, and floatplane dock.

Mitigation – Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

The traffic maintenance and parking plan would include provisions for maintaining pedestrian and bicycle traffic and safety through construction areas. When possible, all roads, sidewalks, and bike paths would be left unobstructed and unaffected so that access would remain available.

4.25.7 Geological Resources

Other than areas that would be permanently altered for development of any of the build alternatives, there would be no direct construction-related impacts to geologic resources. Construction-related soil disturbance could include compaction and/or erosion in temporary staging areas and areas adjacent to permanent right-of-way as a result of movement of construction equipment. Assuming the construction right-of-way would involve 50 feet of temporarily disturbed area adjacent to the permanent right-of-way, on average, the total area of temporary soil disturbance would be between 20 and 45 acres, depending on the alternative.

Mitigation

An erosion and sedimentation control plan would be prepared by a registered engineer and implemented during project construction to minimize soil disturbance. The erosion and sedimentation control plan would provide guidance to construction contractors to reduce construction impacts, particularly those that would result in the destabilization of adjacent slopes. Disturbed areas outside of the permanent right-of-way would be restored to preconstruction conditions. A storm water pollution prevention plan would be prepared by a registered engineer and submitted to the Alaska Department of Environmental Conservation for approval. The storm water pollution prevention plan would be prepared according to Environmental Protection agency general permit guidelines.

4.25.8 Air Quality

Construction of any build alternative would not affect regional air quality. Carbon monoxide and nitrogen oxides emissions from the operation of construction equipment and vehicles would

increase overall concentrations of these pollutants at construction sites, but would not affect the attainment status of the area with respect to the National Ambient Air Quality Standards (NAAQS). The amount of airborne particulate matter up to 10 microns in size (PM₁₀) could be temporarily increased in the immediate vicinity of the construction sites by construction activities such as grading, placement of fill, hauling of materials, and cutting through rock that creates fugitive dust. Because of the frequency of rain in the Ketchikan area, often weather conditions are such that no dust is raised by construction activities.

Mitigation

Measures would be implemented to control fugitive dust (PM₁₀) at construction sites, as needed.

4.25.9 Noise and Vibration

The majority of the potential construction area is primarily open space on Gravina and Pennock Islands. On Revillagigedo Island, construction area would be adjacent to existing industrial, residential and/or commercial properties. Residential areas are considered sensitive noise receptors. Vibrations are also considered disruptive to people, structures, and fish and wildlife.

4.25.9.1 Noise

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), and F3

Construction of a bridge would generate noise from equipment such as motors, chain saws, front-end loaders, cranes, pile drivers, power generators, and diesel-fueled trucks. The effects of construction noise would be most noticeable in the area immediately surrounding the construction site. These alternatives would require construction in the vicinity of residential neighborhoods. Construction noise in these areas could disrupt residential activities.

Mitigation

In accordance with City of Ketchikan noise regulations, construction activities would be prohibited between the hours of 11:00 p.m. and 6:00 a.m. to avoid disruption of residents. Some exceptions to the noise regulations may be requested from the city during special construction activities.

Alternatives G2, G3, and G4

Construction of new ferry facilities for this project would generate noise from equipment; however, there are no noise-sensitive receptors that would be affected by the construction of Alternative G2, G3, or G4.

4.25.9.2 Vibration

Alternatives C3(a), C3(b), C4, D1, and F1 (Preferred)

On Revillagigedo Island, construction of these bridge alternatives would require blasting to remove bedrock. On Gravina and Pennock Islands, the roadway would require minimal blasting to remove bedrock. Vibration associated with the blasting would potentially be felt by residents and wildlife resources in the area of the blasting, but would not have long-term adverse effects on these receptors.

In Tongass Narrows, underwater blasting with explosives and pile driving would generate vibration, which would affect aquatic resources. Vibration impacts to these resources from blasting and pile driving are described in Sections 4.25.12.3 and 4.25.15.

Alternative F3

No blasting of bedrock on Revillagigedo Island is expected for Alternative F3. On Gravina and Pennock Islands, the roadway would require minimal blasting to remove bedrock. Vibration associated with the blasting would potentially be felt by Gravina Island and Pennock Island residents, as well as wildlife resources in the area of the blasting, but would not have long-term adverse effects on these receptors.

In Tongass Narrows, underwater blasting with explosives and pile driving during pier construction and channel widening would generate vibration, which would affect aquatic resources. Vibration impacts to these resources from blasting and pile driving are described in Sections 4.25.12.3 and 4.25.15.

Alternatives G2, G3, and G4

No blasting of bedrock on Revillagigedo Island is expected under any of the ferry alternatives. On Gravina Island, the roadway would require minimal blasting to remove bedrock. Vibration associated with the blasting would potentially be felt by Gravina Island residents, as well as wildlife resources in the area of the blasting, but would not have long-term adverse effects on these receptors.

In Tongass Narrows, underwater blasting with explosives and pile driving during ferry terminal pier construction and would generate vibration, which would affect aquatic resources. Vibration impacts to these resources from blasting and pile driving are described in Sections 4.25.12.3 and 4.25.15.

Mitigation – Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

Blasting would be controlled to avoid damage of nearby structures and to meet the requirements of the local noise ordinance. In-water blasting and pile driving would be controlled to ensure that the pressure waves generated do not pose a consistent, adverse threat to fish and other marine resources. Permit conditions for in-water work would be adhered to during construction.

4.25.10 Water Quality

For all project build alternatives, water quality would be affected by in-water and on-land construction activities that remove vegetation and expose soils; disturb creek and marine sediments; divert creeks; and release fuels, chemicals, construction debris, and other pollutants to the ground surface and nearby water bodies. Runoff from construction sites would transport sediment and pollutants to Tongass Narrows, its tributaries, and lands adjacent to work sites. The potential for water quality impacts is proportional to the time spent constructing close to and within water bodies and wetlands and the amount of surface runoff that occurs during construction. Disturbance of creek and marine sediments during in-water work, such as blasting or dredging, would suspend these sediments within waterbodies. Similarly, disposal of dredged materials associated with channel widening (Alternative F3) would cause temporary suspension of sediments at the disposal location.

Mitigation

Construction of all water body and wetland crossings would adhere to applicable state and federal permit conditions. Runoff from the construction area would be controlled by best management practices (BMPs) to minimize erosion and transport of sediment, to prevent any accidental leaks of oil or fuel from equipment from contaminating creeks or Tongass Narrows, and to contain any such leaks. A storm water pollution prevention plan incorporating BMPs would be prepared by a registered engineer and implemented during project construction to minimize impacts to water quality. BMPs would include provisions for fueling vehicles away from water bodies, use of secondary containment at fueling areas, having spill response equipment readily available, and ensuring that construction personnel are trained in spill response. An erosion and sedimentation control plan and a spill prevention plan would be implemented during construction of any of the build alternatives. In-water work would comply with all permit conditions to minimize sediment suspension to the extent practicable.

4.25.11 Wetlands

For all project build alternatives, construction-related impacts on wetlands could include temporary fill, soil disturbance, vegetation loss, and degraded water quality. Such impacts would occur at staging areas, in areas where temporary fill is required to facilitate the movement of construction equipment, and adjacent to permanent fill footprints. The locations and extent of construction staging areas and temporary fill have not been determined; however, temporary impacts on wetlands would be avoided to the maximum extent practicable. A definitive quantification of affected wetland acreage would be determined for the selected alternative during the design phase.

Mitigation

Use of wetlands for construction activities would be minimized to the extent practicable, and wetlands would be returned to their preconstruction contours and stabilized against erosion once construction equipment and temporary fill are removed. Detailed mitigation measures would be developed and adhered to as conditions of the required federal permits. Mitigation measures would include:

- ◆ Effective revegetation of cut and fill slopes to minimize sediment loading of runoff and maximize pollutant filtering;
- ◆ Minimization of surface disturbance beyond the footprint during construction; and
- ◆ Clear marking of construction limits to minimize accidental disturbance and any consequent temporary and permanent impacts.

4.25.12 Water Body Modification and Wildlife

4.25.12.1 Water Body Modification

Construction activities associated with any of the build alternatives within and along Tongass Narrows would not modify the channel or its shoreline to the extent that water flow or overall channel hydrology would be affected. For all build alternatives, roadway development would require crossings of streams on Gravina Island. Temporary diversions of these water bodies would be required during culvert and possibly bridge placement, which would temporarily alter the configurations of creek banks and beds. Diversion structures might include cofferdams, dams and pumps, pipes, and flumes.

Mitigation

Construction activity in any water bodies would adhere to applicable state and federal permit conditions. Temporary diversions would be designed so that the flow of the water body is not impeded. Any creek banks or beds affected by diversion structure placement would be restored to preconstruction conditions to the maximum extent practicable.

4.25.12.2 Marine Habitat

Bridge pier placement (Alternatives C3[a], C3[b], C4, D1, F1, and F3), channel modification (i.e., associated with Alternative F3), dredging (potentially required for Alternative G3), or ferry dock construction (Alternatives G2, G3, and G4) in Tongass Narrows could degrade or destroy marine habitat outside the project footprint by causing increased erosion, suspension of sediments, and turbidity. The potential for these adverse effects would be greater for the alternatives with roadways near the airport (i.e., Alternatives C3[a], C3[b], C4, and D1), the channel widening associated with Alternative F3, and the potential dredging requirements for Alternative G3 because they would require more work in Tongass Narrows. In most areas, however, the strong currents would quickly dissipate sediment, and the effects on marine habitat would be temporary. Eelgrass beds (which occur in subtidal areas) would not likely be affected by erosion and turbidity because the currents would flush out the finer-grained sediments. Turbidity and sedimentation from erosion are part of the natural cycle in marine systems, and most marine plants and animals are adapted to short-term changes in these parameters; however, if sediment loads are unusually high, last for extended periods of time, or occur at unusual times of the year, adverse impacts to marine habitats could occur.

Mitigation

All applicable state and federal permit conditions would be adhered to throughout the construction phase. To minimize these potential impacts, the DOT&PF would implement construction BMPs, an erosion and sedimentation control plan, and a spill prevention plan during project construction.

4.25.12.3 Wildlife—Aquatic Animals

Aquatic animals would be affected by construction activities from all project build alternatives as a result of increased erosion and sediment suspension, noise, and direct displacement from construction activities.

Sedimentation. For all build alternatives, erosion and turbidity would be caused by the movement of sediment and rock to fill shoreline areas and install in-water piers. Dredging and blasting work associated with Alternative F3 would also cause turbidity by the movement of sediments and rock. Excessive sedimentation could affect existing sedentary organisms in intertidal and subtidal areas; however, waves and currents in intertidal areas, and strong currents in subtidal areas would quickly dissipate waterborne sediment and reduce the amount of sedimentation.

Noise. Construction of a bridge or ferry docks would transmit in-water noise generated by dredging, fill placement, pile driving, blasting, and movement of construction barges. Construction noise generated above the water could also be transmitted into the water through steel or concrete structures. All of these noise sources would temporarily elevate noise levels above the existing background noise levels. If installation of steel piles (24-inch diameter or larger) is required, some injuries or deaths of marine fish in the immediate vicinity are probable from in-water sound pressures generated when the impact hammer strikes the piles.

Construction noise is not expected to have long term or permanent effects on marine and anadromous fish. Effects would be short-term and localized.

Displacement. In-water work, such as blasting and pile driving, would cause the temporary displacement of marine wildlife from the area around the construction activities. Construction activities in eelgrass beds could eliminate important feeding and refuge areas for several species of fish and shellfish, causing displacement of these species. Because of the abundance of similar habitat in Tongass Narrows, it is unlikely that the temporary impacts of construction on fish habitat would have a lasting effect on these species.

Mitigation

Runoff from the construction area would be controlled by BMPs to minimize erosion and transport of sediment. An erosion and sedimentation control plan, spill prevention plan, and BMPs would be implemented during construction to minimize contamination of creeks and Tongass Narrows. Any in-water blasting and pile driving would be controlled to ensure that the pressure waves generated do not pose a consistent, adverse threat to fish and other marine resources.

4.25.12.4 Wildlife—Amphibians

Construction activity related to roadway development on land would disrupt the movements and eliminate habitat of amphibians, which live in wetlands, in creeks, and on land with any of the build alternatives. Because these animals have limited mobility, mechanized clearing outside the project footprint would likely eliminate some of the amphibians living in those areas.

Mitigation

The final alignment of the selected alternative and construction methods would be selected to minimize impacts on wetlands and streams to the extent practicable, and thereby reduce the potential effects of construction on amphibian populations.

4.25.12.5 Wildlife—Birds

Birds in and immediately adjacent to roadway and bridge alignments or ferry terminal areas would be disturbed by construction, which could temporarily displace birds from nesting, resting, and foraging habitat. Nesting waterfowl might abandon nests near the road if disturbed by construction activities. Construction activities might affect individual birds and nest productivity. However, it is expected that birds would relocate to adjacent habitat and the overall impacts on birds would not result in measurable population changes.

Mitigation

All migratory birds are protected under the Migratory Bird Treaty Act. The Migratory Bird Treaty Act (16 USC. 760c-760g) makes it unlawful for anyone to kill, capture, collect, possess, buy, sell, trade, ship, import, or export any migratory bird. Indirect killing of birds by destroying their nests and eggs, is covered by the Act, so construction in nesting areas can constitute a taking. In accordance with USFWS guidelines, DOT&PF would establish a construction activity buffer surrounding active bald eagle nests that could be affected by construction activities. USFWS will be consulted prior to construction to review and comment on the proposed buffer area(s) and to identify additional measures to prevent abandonment of a nest during the breeding season.

4.25.12.6 Wildlife—Land Mammals

Road construction activities would disrupt the activities of land mammals and degrade habitat of land mammals beyond the project footprint with all of the build alternatives. These effects would be greatest on Gravina and Pennock Islands, where there is currently little human activity. Noise and disturbance generated by construction equipment and other human activity would likely drive large land mammals from the area, but would not physically harm them. Most mammals would likely move away from the construction zones to other areas that provide similar habitat. Smaller, less mobile mammals might not be able to move away quickly from construction zones and would be eliminated during construction.

4.25.13 Floodplains

Construction activities would have no effect on floodplains.

4.25.14 Coastal Zone

Temporary construction activities related to any of the build alternatives would not affect coastal zone management. Impacts to the resources protected by the Borough Coastal Management Plan would be minimized through erosion and sediment control and other best management practices for reducing impacts to water quality, wetlands and other water bodies, marine habitat and biota, and threatened and endangered species (see Sections 4.25.10, 4.25.11, 4.25.12, and 4.25.15).

4.25.15 Threatened and Endangered Species

4.25.15.1 Steller Sea Lions

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), and F3

Based on a June 4, 2001, consultation letter from NOAA Fisheries and based on other research, Steller sea lions would not likely be affected by underwater noise associated with most construction activities because they have relatively high thresholds for noise disturbance and are able to lift their heads out of the water to avoid noise transmission. The sea lions within Tongass Narrows are commonly subjected to moderate levels of disturbance and noise from cruise ships and other ships passing through.

Construction activities that require pile driving and underwater explosives could adversely affect Steller sea lions through high noise levels and vibration. Such activity could cause temporary disturbances to sea lions including avoidance, startle response, and complete abandonment of the area. In addition, pile driving and underwater blasting could disrupt short-term behavior by causing agitation, stress, and disturbance of foraging activities. There might also be temporary disruptions of normal communication and auditory ability of sea lions in the vicinity of the pile driving and underwater blasting area. However, impacts associated with pile driving and underwater explosives would be temporary, and it is expected that Steller sea lions would avoid the area during these activities, and then return to their normal behavior patterns once these activities were completed.

Mitigation

To mitigate the effects of underwater blasting, the contractor would be required to prepare a blasting plan prior to any blasting activities. A pre-blasting survey would be required to ensure that no sea lions are in the vicinity of the blasting area. Qualified observers would be on hand

during pile driving and/or blasting to monitor for the presence of Steller sea lions, and work would be suspended when sea lions were in the construction area. All project-related activities would conform to the pertinent provisions of the Marine Mammal Protection Act and the Endangered Species Act.

Alternatives G2, G3, and G4

Construction activities associated with the ferry alternatives would have little or no effect on the Steller sea lions because in-water construction would be limited. Any dredging activities that may be required under Alternative G3 would cause temporary disturbances to sea lions including avoidance, startle response, and complete abandonment of the area. However, impacts associated with dredging would be temporary, and it is expected that Steller sea lions would avoid the area during these activities, and then return to their normal behavior patterns once the construction activities were completed.

Mitigation

To mitigate the effects of dredging, work would be suspended while sea lions were in the construction area. All project-related activities would conform to the pertinent provisions of the Marine Mammal Protection Act and the Endangered Species Act.

4.25.15.2 Humpback Whales

Humpback whales could be affected directly by underwater noise from construction work in Tongass Narrows under any of the build alternatives. Humpback whales passing through Tongass Narrows could be displaced temporarily as a result of high noise levels. Most evidence suggests that whales avoid loud noises, which might result in temporary displacement of these animals from typical foraging or traveling areas.

Mitigation

Qualified observers would be on hand during construction activities to monitor for the presence of humpback whales. Work would be suspended while whales are present in the construction area. All project-related activities would conform to the pertinent provisions of the Marine Mammal Protection Act and the Endangered Species Act.

4.25.16 Historic and Archeological Preservation

Construction activities could have direct impacts on historic and archeological features within the construction area of disturbance. There are no known historic or archeological resources within the Area of Potential Effect of any of the proposed alternatives except Alternatives F1 and F3 (see Section 4.21). As described in Section 4.21, KET-774 and KET-775 could be affected by construction activities under Alternative F1 only. Other archeological sites are known to exist in the Tongass Narrows area, and previously unknown subsurface sites could be discovered during construction.

Mitigation

See Section 4.21. If new properties with potential to be eligible for inclusion in the National Register were discovered during construction, construction at that location would halt for site evaluation. If a site were found to be eligible for the National Register of Historic Places, it would be avoided, or DOT&PF and FHWA would develop a memorandum of agreement with the SHPO to mitigate adverse effects.

4.25.17 Hazardous Waste Sites

Construction activities associated with any of the build alternatives would not affect any known hazardous waste sites. Sites recognized as potential hazardous waste sites within the construction right-of-way (see Section 4.22 Hazardous Waste Sites) would be investigated prior to construction and any waste found would be removed in accordance with state and federal regulations.

Hazardous materials that would be used, transported, or stored within the project right-of-way as part of the construction activities could adversely affect the environment if not properly handled and contained. Materials would include asphalt, concrete, cable lubricants, equipment fuel and lubricants.

Mitigation

Hazardous materials used during project construction will be stored and handled according to state and federal regulations. Material Safety Data Sheets will be available for all hazardous materials on the site. A spill prevention and response plan will be developed for the selected alternative. Construction vehicles will contain spill prevention kits in case of minor hazardous materials or chemical spills during construction.

4.25.18 Visual Environment

4.25.18.1 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), and F3

Temporary visual impacts resulting from construction could include the presence and use of equipment and materials (e.g. spoil piles, cones). Construction of the bridge alternatives would temporarily vary the current views of natural features with the introduction of large cranes, barges, and other operating equipment in the channel. Because of the industrial character of the Ketchikan waterfront, the impact on the visual environment of that shoreline would be minor. As the bridge construction work progresses into Tongass Narrows and, in the case of Alternatives F1 and F3, the East and West channels, construction equipment would intrude upon views of predominantly natural features.

Construction of roadways and bridge approaches would adversely affect the visual character of the area immediately surrounding the construction zones. This temporary effect would have a minor impact on visual resources. Construction of roadways and bridge approaches on Gravina and Pennock Islands would not be visible from most areas of Ketchikan.

4.25.18.2 Alternatives G2 and G3

Construction of the new ferry terminals for Alternative G2 or G3 on Gravina Island, amid the existing natural features, would have an impact on views of the shoreline. An uninterrupted natural shoreline view would be converted to a view of a segmented shoreline with a cleared area and construction equipment.

Construction of a ferry terminal for Alternatives G2 and G3 on Revillagigedo Island would not dramatically change the visual setting due to the industrial and commercial character, respectively, of the terminal sites.

4.25.18.3 Alternative G4

The construction of this ferry terminal on Gravina and Revillagigedo Islands would occur in industrial areas. Construction equipment and activity would therefore not have a visual impact with Alternative G4.

4.25.18.4 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

All construction equipment and debris would be removed after construction is completed.

4.25.19 Energy

Energy consumption related to each of the build alternatives depends on the duration of construction and the types of construction equipment required. These factors have not been determined and, therefore, energy consumption related to the construction of each alternative is not known. Impacts on energy supply are not expected.

4.25.20 Utilities

Construction of any of the project alternatives would have no temporary effect on utilities.

4.26 SECONDARY IMPACTS

After examining the existing conditions of the affected environment and the direct impacts of the proposed project, the project team considered how the various directly affected resources are related to other resources and how the direct impacts on affected resources might cause impacts on these related resources. This analysis identifies secondary impacts.

An important component of the secondary impact analysis of the Gravina Access Project is the estimate of the potential development that would be induced by the project within a reasonable period of time. According to the FHWA Position Paper on *Secondary and Cumulative Impact Assessment In the Highway Project Development Process* (April 1992):

New access to undeveloped locations can contribute to subsequent development activity. In some instances, the stated purpose for proposed projects may be to promote economic development in depressed areas needing overall infrastructure improvement. In cases like these, a discussion of the indirect effects should be included in the project environmental analysis. Without it the project purpose and need will be difficult to defend and any decisions to proceed with the project may likely be challenged.

Part of the stated purpose and need of the Gravina Access Project (in Chapter 2) is to improve access to Borough land and other developable or recreation lands on Gravina Island to support the adopted land use plans of the Borough, and to promote environmentally sound, planned long-term economic development on Gravina Island. The degree of development that could occur on Gravina Island (i.e., low, medium, and high) is based on projections for economic growth in the Borough³⁵ and the type and location of the alternatives' alignments (i.e., bridge alternatives near the airport, the Pennock Island alternatives, ferry alternatives, or the No Action alternative).

³⁵ DOT&PF, *Gravina Access Project, Ketchikan Gateway Borough Economic Forecasts Technical Memorandum*, prepared by Northern Economics under contract to HDR Alaska, August 2002.

To determine how much of the future growth expected in the Borough might be attributable to Gravina Island, economists and planners have looked at Gravina Island land ownership patterns; the plans of federal, state, and borough landowners; economic growth potential for the region; and current development patterns. They have looked at each Gravina Access Project alternative for its level of convenience, user cost, and location to determine how it might influence development on Gravina Island, and they have worked with Borough planners, who developed the *Pennock and Gravina Island Neighborhood Plan* (April 2002), to characterize development patterns on Gravina Island.

The analysis of secondary impacts in this Section 4.26 is based on the development that would occur under the medium economic growth condition. Medium economic growth for the region assumes the following:

- ◆ In 2025, the population of the Borough will be 18,300 people, representing a compound annual growth rate of less than 1 percent from 14,070 in 2000.
- ◆ In 2025, total employment (jobs) in the Borough will be 8,500.
- ◆ The veneer plant will reopen in the near term and Tongass timber harvests will stabilize after that time.
- ◆ Seafood harvesting and processing employment will not change significantly over the long term although short-term fluctuations will continue.
- ◆ In the near term (by 2009), employment related to shipyard activities will increase moderately, (perhaps by 25 more jobs), and then will increase by 2 percent per year.
- ◆ Tourism expenditures will increase—at 2 percent per year to 2005, then at 3 percent per year to 2010, and then at 2 percent per year after 2010.
- ◆ Spending and employment related to state or local government will change very little.
- ◆ Continued community growth will require approximately 1,730 acres of additional land for future commercial, industrial, residential, and community uses.³⁶

Development induced by the Gravina Access Project has been projected through 2025. On Revillagigedo Island, project-induced development is based on the analysis of economic impacts of the project (see Appendix D). Project-induced development on Pennock Island (i.e., from Alternatives F1 [Preferred] and F3) is based on the assumption that local transportation access and infrastructure would connect developable land on the island to the Alternative F1/F3 alignment.³⁷ On Gravina Island, project-induced development is based on the development scenarios presented in the *Gravina Access Project Traffic Projections Technical Memorandum*.³⁸

³⁶ Ibid.

³⁷ The Borough Assembly has indicated that, with the selection of Alternative F1 as the preferred alternative, it will request the Borough Planning Department to update the Pennock Island Plan. Such a plan would include a framework for local transportation access and infrastructure. The framework for local transportation and infrastructure would provide the connection with the proposed road across Pennock Island.

³⁸ DOT&PF, *Gravina Access Project Traffic Projections Technical Memorandum*, prepared by Northern Economics, Inc. under contract to HDR Alaska, November 2002.

The Gravina Island development scenarios associated with the project alternatives, assuming medium economic growth, are summarized in Table 4-16 (Development Scenarios Assumed for Gravina and Pennock Islands in the Secondary Impact Analysis).

**TABLE 4-16
DEVELOPMENT SCENARIOS ASSUMED FOR GRAVINA AND PENNOCK ISLANDS IN THE
SECONDARY IMPACT ANALYSIS**

<i>Project Alternatives</i>	<i>Type and Location of New Development by 2025 Assuming Medium Economic Growth</i>
No Action Alternative	<u>Gravina Island</u> 3.9 miles of gravel road to Borough lands north of airport 5 acres developed for industrial use 15 acres developed for residential use <u>Pennock Island</u> No additional development anticipated
Alternatives C3(a), C3(b), C4, and D1	<u>Gravina Island</u> 5 acres of land developed for airport-related industries 2 acres developed for limited retail 15 acres developed for industrial use 287 acres developed for residential use 1 acre dedicated to community use <u>Pennock Island</u> No additional development anticipated
Alternatives F1 and F3	<u>Gravina Island</u> 5 acres of land developed for airport-related industries 2 acres developed for limited retail 15 acres developed for industrial use 383 acres developed for residential use 1 acre dedicated to community use <u>Pennock Island</u> 75 acres for residential use 1 acre developed for retail/commercial use
Alternatives G2, G3, and G4	<u>Gravina Island</u> 5 acres of land developed for airport-related industries 50 acres developed for residential use 2 acres developed for limited retail 15 acres developed for industrial use 1 acre dedicated to community use <u>Pennock Island</u> No additional development anticipated
Source: Gravina Access Project Traffic Projections Technical Memorandum, prepared by HDR Alaska, November 2002	

4.26.1 Land Use Impacts

The development scenarios in combination with the *Pennock and Gravina Island Neighborhood Plan* were used to determine where the land use changes would likely occur. The *Pennock and Gravina Island Neighborhood Plan* identifies five areas for planning purposes: North Gravina (which includes Rosa Reef), Central Gravina and Airport Reserve, Clam Cove and Blank Inlet,

Vallenar Bay, and Tongass National Forest (see Figure 3.4). The locations of future development on Gravina Island described below are based on the Borough plans for these five areas relative to the location of the alternative under consideration. For example, Alternative G2 would likely result in development on Gravina Island north of the airport, which could include development within the North Gravina and Vallenar Bay areas identified in the *Pennock and Gravina Island Neighborhood Plan*.

4.26.1.1 No Action Alternative

Overall development in the Borough would continue under the No Action Alternative, corresponding to the growth in population. Gravina Island, without improved access, would experience a small portion of the region's future development. By 2025, Gravina Island would add 5 acres of industrial development and 15 acres of residential development north of the airport. Most industrial development is projected to occur within the Central Gravina and Airport Reserve area, whereas residential development would occur in the North Gravina area. These sites would be accessible by the proposed Borough road extending from the airport to the Borough-leased industrial lands north of the airport. The land use would be converted from open space and forested areas to developed land.

On Revillagigedo and Pennock Islands, with medium growth in the local economy, development would continue at a rate and in a pattern similar to those of the past 10 years. On Pennock Island, a few residential lots could be developed. On Revillagigedo Island, the fastest-growing residential areas would be near Point Higgins (about 15 miles north of downtown Ketchikan); future residential development is anticipated to occur increasingly farther from downtown Ketchikan.

The benefits of the build alternatives, described below, would not occur. Land use would continue to be constrained on Revillagigedo Island, where mostly marginal lands (steep, or wet) are left for development. Access by the borough to its lands on Gravina Island, as suggested in Title 29 of the Alaska Statutes (regarding land grants; see Chapter 1), would not improve. These lands would remain functionally unavailable to the borough for the foreseeable future. This would also be true of airport reserve and Mental Health Trust lands on Gravina Island.

4.26.1.2 Alternatives C3(a), C3(b), C4, and D1

Improved access to Gravina Island under Alternatives C3(a), C3(b), C4, and D1 would shift about 20 percent of the future development activity from Revillagigedo Island to Gravina Island as borough, airport, and other lands were made directly accessible by road. This would be a substantial beneficial impact for the borough, as it would provide greater options and opportunity for commerce, industry, and residences. It would also reduce land use constraints on the east side of Tongass Narrows.

On Gravina Island, industrial and commercial uses near the airport (Central Gravina and Airport Reserve area) and north of the airport (North Gravina area) would occupy approximately 22 acres of land that had been used as open space and forested areas along the Tongass Narrows waterfront and is zoned for industrial/commercial development. Approximately 288 acres of open space and forested land would be converted for use as residential or community development. Most of the new residential development would be located in the North Gravina area, and some could occur in the Vallenar Bay area. Most of the new land development would be accessed via gravel roads connecting with the project's new roadway. The change in land

use on Gravina Island associated with this level of development would be consistent with the planned and existing land uses (i.e., existing residential development north of the airport; industrial development on the Airport Reserve property, and north of the airport).

4.26.1.3 Alternatives F1 (Preferred) and F3

Alternatives F1 and F3 would shift about 25 percent of the future development activity from Revillagigedo Island to Gravina Island and about 9 percent to Pennock Island as borough, airport, and other lands were made directly accessible by road. This would be a substantial beneficial impact for the borough (greatest of the alternatives), as it would provide greater options and opportunity for commerce, industry, and residences. It would also reduce land use constraints on the east side of Tongass Narrows.

On Gravina Island, industrial and commercial uses near the airport (Central Gravina and Airport Reserve area) and north of the airport (North Gravina area) would occupy approximately 22 acres of land that had been used as open space and forested areas along the Tongass Narrows waterfront and is zoned for industrial/commercial development. Approximately 383 acres of residential development and 1 acre of community development would be induced by either of these alternatives, most of which would occur south of the airport (Clam Cove and Blank Inlet area). Very little project-induced development is expected to occur in the Vallenar Bay area.

Pennock Island would also experience development, with approximately 75 additional acres of residential development and 1 acre of retail/commercial development. Most development would likely occur along the waterfront in areas that are currently undeveloped and used as open space and forested land. This level of development would be consistent with the development anticipated in the *Pennock and Gravina Island Neighborhood Plan*, adopted May 6, 1985 (the only planning document, though outdated, that addresses Pennock Island at the present time; *Ketchikan 2020* is expected to supercede it (see Section 3.1.2.1).

4.26.1.4 Alternatives G2 and G4

Alternatives G2 and G4 would shift about 6 percent of the future development activity from Revillagigedo Island to Gravina Island as borough, airport, and other lands were made directly accessible by road. This would be a beneficial impact for the borough, as it would provide greater options and opportunity for commerce, industry, and residences. It would also reduce land use constraints on the east side of Tongass Narrows.

On Gravina Island, industrial and commercial uses near the airport (Central Gravina and Airport Reserve area) and north of the airport (North Gravina area) would occupy approximately 22 acres of land that had been used as open space and forested areas along the Tongass Narrows waterfront and is zoned for industrial/commercial development. Approximately 50 acres of residential and 1 acre of community development would be induced by either of these alternatives. Most of the new residential development would be located in the North Gravina area, and some could occur in the Vallenar Bay area. Most of the new land development would be accessed via gravel roads connecting with the project's new roadway. The change in land use on Gravina Island associated with this level of development would be consistent with the planned and existing land uses (i.e., existing residential development north of the airport; industrial development on the Airport Reserve property, and north of the airport).

4.26.1.5 Alternative G3

Alternative G3 would shift about 6 percent of the future development activity from Revillagigedo Island to Gravina Island as borough, airport, and other lands were made directly accessible by road. This would be a beneficial impact for the borough, as it would provide greater options and opportunity for commerce, industry, and residences. It would also reduce land use constraints on the east side of Tongass Narrows.

On Gravina Island, industrial and commercial uses near the airport (Central Gravina and Airport Reserve area) and north of the airport (North Gravina area) would occupy approximately 22 acres of land that had been used as open space and forested areas along the Tongass Narrows waterfront and is zoned for industrial/commercial development. Approximately 50 acres of residential and 1 acre of community development would be induced by either of these alternatives. Most of the new residential development would be located in the North Gravina area, and some could occur in the Central Gravina and Airport Reserve area. Most of the new land development would be accessed via gravel roads connecting with the project's new roadway. The change in land use on Gravina Island associated with this level of development would be consistent with the planned and existing land uses (i.e., existing residential development north of the airport; industrial development on the Airport Reserve property, and north of the airport).

4.26.2 Social Impacts

The secondary impacts on the social environment would result primarily from changes in access to and new development on Gravina Island. Assuming medium economic growth for the region through 2025, the population in the Borough would increase from 14,070 in 2000 to approximately 18,300 in 2025. Total employment (jobs) in the Borough would be about 8,500 in 2025.

4.26.2.1 No Action Alternative

The No Action Alternative would not improve the social environment of Ketchikan because it would not improve access to developable lands that would be needed to support growth in the community. On Revillagigedo Island, community services and facilities would need to be expanded to meet the needs of the growing population. Limitations on available land would have an adverse impact on the Ketchikan community by constraining the locations of development of any such facilities. These limitations might also constrain residential development, creating denser neighborhoods, which would change neighborhood character. Constraints on available industrial land would limit the types of industries that could be developed in the Ketchikan region, which could diminish the availability of employment opportunities.

The restricted access to Gravina Island (via the existing airport ferry) also would continue to limit recreational use of the island.

On Gravina Island, the growth in population and employment could result in the formation of one or more new small neighborhoods. New industrial/commercial and residential developments on Gravina Island would rely on existing community services and facilities available from Revillagigedo Island.

Competition for subsistence resources on Gravina and Pennock Islands would not be affected by the No Action Alternative.

4.26.2.2 Alternatives C3(a), C3(b), C4, and D1

By providing improved access to Gravina Island, these alternatives would promote growth and development on the island. The availability of developable land in the Borough would increase and the locations of new development would be less constrained than under the No Action Alternative. With more industrial development shifting to Gravina Island, there would be more opportunities for other types of development (e.g., residential and commercial/retail) on Revillagigedo Island, particularly along the waterfront. The residential development on Gravina Island could occur in cluster areas, such as Rosa Reef, which could lead to neighborhood structure and cohesiveness. Improved access to Gravina Island would also increase recreational opportunities in the Ketchikan area.

Competition for Gravina Island subsistence resources could increase as a result of the implementation of Alternatives C3(a), C3(b), C4, or D1 and have an adverse effect on these resources.

The projected development on Gravina Island would increase the need for community services and facilities. Most services (e.g., those provided by schools, libraries, and medical facilities) would continue to be obtained from Revillagigedo Island. However, emergency response services (e.g., fire protection and ambulance service) would likely be enhanced on Gravina Island, although such services would likely continue to be physically located on Revillagigedo Island through 2025. Community services and facilities on Revillagigedo Island would likely be expanded to meet the needs of the growing population of the region.

4.26.2.3 Alternatives F1 (Preferred) and F3

By providing better access to Gravina and Pennock Islands, these alternatives would promote growth and development on those islands. The availability of developable land in the Borough would increase and the locations of new development would be less constrained than under the No Action Alternative. With more industrial development shifting to Gravina Island, there would be more opportunities for other types of development (e.g., residential and commercial/retail) on Revillagigedo Island, particularly along the waterfront. The residential development on Gravina Island could occur in cluster areas, such as Clam Cove, which could lead to neighborhood structure and cohesiveness. Improved access to Gravina Island would also increase recreational opportunities in the Ketchikan area.

Roadway access to and increased development of Pennock Island would substantially change its neighborhood character. As indicated by the input from Pennock Island and Clam Cove residents at the May 2001 workshops (see Section 4.3.3.2 and Appendix B), the Pennock Island community is divided with respect to its vision for future development on access to the island as a result of these alternatives. The Borough would likely revise the *Pennock and Gravina Island Neighborhood Plan*³⁹ to respond to the change in access to Pennock Island and ensure that the future development of the island would occur within an appropriately planned framework.

³⁹ Ketchikan Gateway Borough Planning Department, *Neighborhood Plan*.

Competition for subsistence resources on Gravina and Pennock Islands could increase as a result of implementation of Alternatives F1 or F3 and have an adverse effect on these resources.

The projected development on Gravina and Pennock Islands would increase the need for community services and facilities. Most services (e.g., those provided by schools, libraries, and medical facilities) would continue to be obtained from Revillagigedo Island. However, emergency response services (e.g., fire protection and ambulance service) would likely be enhanced on Gravina and Pennock Islands, although such services would likely continue to be physically located on Revillagigedo Island through 2025. Community services and facilities on Revillagigedo Island would likely be expanded to meet the needs of the growing population of the region.

4.26.2.4 Alternatives G2, G3, and G4

The new ferry access to Gravina Island associated with these alternatives would promote modest amount of growth and development on the island (53 additional acres of growth), representing a 6 percent shift of the future development activity from Revillagigedo Island to Gravina Island. The improved access offered by the additional ferry would not significantly relieve the development constraints on Revillagigedo Island because some of the community would still perceive access to Gravina Island as inconvenient.

Although some of the Ketchikan community would perceive continued limitation on available land under these alternatives, industrial and commercial development would occur on Gravina Island, leaving more opportunities for other types of development (e.g., residential and commercial/retail) on Revillagigedo Island, particularly along the waterfront. This would have a positive impact on the Ketchikan area.

The restricted access to the island (via the new and existing airport ferry) also would continue to limit recreational use of the island. This would have an adverse impact on recreation in the project area.

On Gravina Island, the growth in population and employment could result in the formation of one or more new small neighborhoods and development of approximately one acre for community services or facilities. New industrial/commercial and residential developments on Gravina Island would primarily rely on existing community services and facilities available from Revillagigedo Island, but would not adversely affect these facilities.

Competition for Gravina Island subsistence resources could increase as a result of Alternatives G2, G3, and G4 and have an adverse effect on these resources.

4.26.3 Economic Impacts

The project's secondary impacts on the economy and economic development are related to:

- ◆ The ability of the construction industry in the Borough to participate in constructing the alternatives
- ◆ Changes in spending associated with project operations

- ◆ Changes in transportation patterns (aviation, marine navigation, and vehicles)
- ◆ The effect of regional economic activity on development on Gravina and Pennock Islands
- ◆ Fiscal impacts on the local economy and government services

These impacts are addressed in the following sections in general terms for the No Action Alternative and the build alternatives, unless otherwise specifically stated. Detailed descriptions of these impacts are provided in Appendix D.

The Gravina Access Project is not expected to substantially impact the amount of timber harvested from Gravina Island. Specifically, it is not expected to increase the likelihood of or the volume of timber harvest anticipated in the USFS Gravina Island Timber Sale DEIS.

4.26.3.1 Indirect and Induced Construction Spending

When a bridge, road, or ferry is built in Alaska, the construction firms contracted for the project directly benefit (i.e., there is a direct project impact). These construction firms, in turn, spread the benefits by buying supplies from other Alaska firms and hiring workers. The suppliers make additional purchases, as do the project workers. A large share of purchases might also be transferred out of the local economy by out-of-state purchases. The additional rounds of spending caused by construction firm expenditures are part of the subsequent indirect and induced effects, which are often collectively referred to as secondary effects.

The potential secondary economic effects of construction spending are estimated using an economic input-output (I-O) model available from the Minnesota IMPLAN⁴⁰ Group. The company uses a variety of data sources to construct economic models of the economy of each state, county, and borough in the U.S. The I-O model captures the inter-industry transactions generated by the construction firms and their suppliers, and the additional economic activity generated by household and government spending that would result from construction of a project alternative. The data provided in this Section 4.26.3 were estimated using the Borough I-O model.

Employment. Indirect employment effects relate to full-time and part-time jobs created as a result of spending by businesses, households, and local governments that directly support the project. Table 4-17 includes jobs representing the number of persons employed in activities stimulated by inter-industry transactions and the employment created by additional household and government spending. The estimates do not include direct employment of workers involved in construction activities. Each of the improved ferry alternatives (G2, G3, and G4) assumes that the two new ferry vessels will be built at the Ketchikan Shipyard between 2003 and 2005. The improved ferry alternatives and the No Action Alternative include replacement of an existing ferry vessel (also built at the Ketchikan Shipyard) in 2015. If the ferry vessels were built elsewhere, the number of secondary jobs would be less than presented in Table 4-17. The bridge alternatives have a greater capital cost, and therefore generate more secondary jobs than the ferry alternatives.

⁴⁰ "IMPLAN" was originally an acronym for "impact analysis for planning."

Gross Regional Product. Table 4-17 also provides the estimated changes in the gross regional product and labor income generated by construction of each of the project alternatives. The change in gross regional product (also called output) is a measure of the total change in economic activity of the region (in this case attributable to project construction), including both inputs into other industries and outputs consumed by governments and individuals.⁴¹

Labor Income. Labor income is a measure of the change in payments made to labor as well as proprietor's income (income received by self-employed individuals) as a result of project construction and subsequent spending by industry, households, and governments.

Government Revenues. The I-O model uses state and borough-level data sources as well as the *Annual Survey of Government Finances*⁴² in estimating the state and local government revenues that can result from additional economic activity in the region.

Based on the I-O model for the region, the build alternatives can potentially generate additional government revenues of between \$1.2 million (Alternative D1) and \$2.0 million (Alternative F3); see Table 4-17. These estimates include indirect taxes paid by businesses, such as excise taxes, property taxes, fees, licenses, and sales taxes paid by business. The estimates also include payments by households to state and local governments for estate and gift taxes, motor vehicle licenses, property taxes, fishing and hunting fees, and other taxes, fees, and charges. Unemployment taxes from both businesses and households are also included.

**TABLE 4-17
SECONDARY EFFECTS OF CONSTRUCTION SPENDING
ON EMPLOYMENT, INCOME, AND GOVERNMENT REVENUE**

Secondary Effect	No Action Alternative	Bridge Alternatives						Ferry Alternatives		
		C3(a)	C3(b)	C4	D1	F1	F3 ¹	G2	G3	G4
Total Employment (Jobs)	10	250	220	270	200	310	310	130	130	120
Annual Employ. (Jobs) ²	5	80	70	90	70	100	100	40	40	40
Gross Regional Product (\$million) ³	N.A. ⁴	22.4	20.1	25.1	17.3	28.1	24.4	11.8	15.9	11.1
Labor Income (\$million) ³	N.A. ⁴	8.7	7.5	9.2	6.6	10.4	9.6	4.5	4.9	3.8

⁴¹ Households are the common unit of measure used in input-output analysis for persons or individuals.

⁴² U.S. Bureau of the Census, 2001.

		Bridge Alternatives						Ferry Alternatives		
State Revenue (\$million) ³	N.A. ⁴	0.6	0.6	0.7	0.5	0.9	0.9	0.6	0.7	0.6
Local Revenue (\$million) ³	N.A. ⁴	0.8	0.7	0.9	0.7	1.0	1.1	0.7	0.8	0.7

¹ Assumes channel modification would be required.

²Total employment divided by 3-year construction period for the bridge alternatives. Annual employment for the improved ferry alternatives uses 3 years for initial construction and 1-year for ferry replacement and terminal rehabilitation in the tenth year of operation. A 2-year construction period is used for the No Action Alternative. Numbers may not calculate due to rounding. The jobs shown for the No Action Alternative are not a result of the Gravina Access Project, as they would occur in the absence of any action; the jobs are associated with periodic replacement and maintenance activities for the existing ferry system.

³ 2003 dollars

⁴ Not applicable; not a result of the Gravina Access Project.

Table 4-17 illustrates that F1 has the greatest secondary beneficial economic effects of the build alternatives in the categories of gross regional product and labor income. Alternatives F1 and F3 have similar benefits for total employment and annual employment, and local and state revenues created by Alternative F1 are slightly less than those revenues generated by Alternative F3. Alternatives C3(a) and C4 are the next most beneficial alternatives with respect to the economy. Alternative G4 has the least secondary beneficial economic effects for employment and gross regional product.

4.26.3.2 Changes in Spending Associated with Project Operations

Secondary spending associated with long-term operations and maintenance of the project alternatives can be represented by gross regional product; labor income, other property type income (such as rents), and indirect business taxes; and employment that can potentially be generated in the Borough from the annual operations and maintenance of the structures, equipment, and facilities built for each of the alternatives, and changes in discretionary spending due to the presence or absence of tolls for the various alternatives. Effects on state and local revenues from long-term use of the project are described in Section 4.26.3.5.

Table 4-18 illustrates that the build alternatives would have minimal effects on gross regional product; labor income, other property type income, and indirect business taxes; and employment. Operations and maintenance of Alternatives G2, G3, G4, and the No Action Alternative is funded primarily by tolls from users.⁴³ Tolls reduce the discretionary spending available to users and reduce the amount that can be spent elsewhere in the local economy.

Gains in employment and economic activity with the ferry alternatives would be offset by losses in other sectors for a net effect of zero.⁴⁴

⁴³ Grants and other sources provide funds for periodic replacement and refurbishment of facilities and equipment. Replacement and refurbishment activities are included in construction.

⁴⁴ Economic activity associated with increased discretionary spending would have different effects on sectors within the local economy but the total effects in aggregate would be similar.

TABLE 4-18
ANNUAL SECONDARY ECONOMIC EFFECTS OF OPERATIONS

Secondary Effect	No Action Alter- native	Bridge Alternatives						Ferry Alternatives		
		C3(a)	C3(b)	C4	D1	F1	F3 ¹	G2	G3	G4
Gross Regional Product (millions of 2003\$)	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Total labor income, other property type income, and indirect business taxes (millions of 2003\$)	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Employment (Jobs)	0	2	2	2	1	1	1	0	0	0

¹ Assumes channel modification would be required.

4.26.3.3 Economic Effects of Changes in Aviation Operations

No Action Alternative and Alternatives G2, G3, and G4

Neither the No Action Alternative nor the ferry alternatives would affect aviation in a way that would have a secondary impact on the local or regional economy.

Alternatives C3(a), C3(b), C4, and D1

The construction of a bridge alternative might lead to changes in or the possible elimination of the SVFR clearance, which currently governs some air traffic in the Borough.⁴⁵ The FAA anticipates that some type of change should be expected under all of the bridge alternatives but the level of impact varies with the alternatives.⁴⁶ Those alternatives that would be constructed in the vicinity of the airport would have the greatest effect on aircraft operations. Any bridge alternative may require adjustment to or elimination of the SVFR minimums. Through a separate public process, the FAA would make this determination. In addition, it is anticipated that air charter operators and others would seek modification of the SVFR or changes in operating procedures (i.e., wheel-based operations instead of floatplane operations) to offset the presence of the bridge alternatives and the potential adverse impacts on their businesses. To account for this uncertainty there is a wide range of probabilities for the various scenarios.

The presence of Alternatives C3(a), C3(b), C4, and D1 would allow less than 10 percent of current SVFR operations. The net loss to the Ketchikan economy of these eliminated trips (including indirect and induced effects as estimated from a regional economic model) would be approximately \$410,000 annually for Alternatives C3(a), C3(b), C4, and D1.

⁴⁵ A decision has not yet been made regarding elimination of the SVFR clearance if a bridge is constructed. Presumably safety considerations would be the main factor. But it does not appear that collisions between aircraft and man-made structures cause many air crashes in Alaska. According to data from the National Transportation Safety Board, there were nine aircraft crashes involving a plane or helicopter striking a building, tower, or other man-made structure in Alaska between 1983 and 2001; none of these crashes involved a bridge.

⁴⁶ Green, July 15, 2002.

Alternatives F1 (Preferred) and F3

Alternatives F1 and F3 are outside of the current boundaries of the SVFR airspace but the proximity of these bridge alternatives to the SVFR area may require some adjustment of the exemption. For purposes of this analysis, DOT&PF assumed that, with Alternatives F1 and F3 in place there would be reductions of 10 and 5 percent, respectively, of current SVFR operations (see Section 3.7.1). The net annual loss to the Ketchikan economy of these eliminated trips (including indirect and induced effects as estimated from a regional economic model) would be approximately \$82,000 for Alternative F1 and \$41,000 for Alternative F3.

4.26.3.4 Economic Effects of Changes in Cruise Ship Operations

Cruise Ship Spending. A significant portion of the Ketchikan economy relies on its status as a port of call for the cruise ship industry. The greatest secondary economic impacts resulting from primary impacts on marine navigation would be from changes in cruise ship operations (i.e., fewer or shorter port calls) as a result of the bridge alternatives. There are three types of on-shore spending related to cruise ship calls:

- ◆ Spending by cruise ship passengers for tours, sightseeing, gifts, souvenirs, food, and beverages
- ◆ Purchases made by cruise ship crewmembers
- ◆ Direct spending by the cruise line for ship docking, tug services, pilots, and miscellaneous supplies

Table 4-19 summarizes average spending in Ketchikan related to cruise ship port calls.

**TABLE 4-19
CRUISE SHIP SPENDING (PER PORT CALL)**

	<i>Average Number per Ship</i>	<i>Average Spending per Person</i>	<i>Total Spending per Port Call</i>
Passengers	1,664	\$95	\$158,080
Crewmembers	727	\$15	\$10,900
Cruise Line	--	---	\$22,100
Total	2,391	---	\$191,080
Source: Economic Impact of Cruise Line Spending in Southeast Alaska in 1999, prepared for the Southeast Conference by the McDowell Group, 2000			

Per-Hour Spending. While information exists on average passenger spending per port call in Ketchikan, there is no current information available on passenger spending per hour during a port call. Spending by passengers would vary by ship, length of time in port, direction of the cruise (northbound versus southbound), and weather conditions. To assess the potential effects of reduced port time by those ships visiting Ketchikan, several assumptions have been made about spending by usable hours in port. Assuming that passenger spending varies with the duration of the port call and by hour (with more spending occurring early in the port call than later) and quantifying the shore excursion spending during the first hour, an estimate can be made of spending by hour. For ships with longer usable port time, it is assumed that the second wave of shore excursion spending is reflected in the fourth hour.

Using these assumptions, Table 4-20 provides an estimate of average passenger spending for each hour in port.

**TABLE 4-20
ESTIMATED CRUISE SHIP PASSENGER HOURLY SPENDING
(PER PORT CALL)**

<i>Hour</i>	<i>Usable Port Time</i>				
	<i><5.0 hours</i>	<i><6.0 hours</i>	<i><7.0 hours</i>	<i><8.0 hours</i>	<i>8.0 hours or more</i>
1	\$38.56	\$44.00	\$47.50	\$42.00	\$46.92
2	\$17.53	\$16.00	\$14.25	\$10.50	\$11.73
3	\$10.52	\$12.00	\$14.25	\$10.50	\$11.73
4	\$3.51	\$4.00	\$9.50	\$21.00	\$23.46
5		\$4.00	\$4.75	\$10.50	\$11.73
6			\$4.75	\$5.25	\$5.87
7				\$5.25	\$5.87
8+					
Totals	\$70.11	\$80.00	\$95.00	\$105.00	\$117.31

Source: DOT&PF, Gravina Access Project *Effects on Cruise Ship Operations*, prepared by Klugherz & Associates/Northern Economics, Inc. under contract to HDR Alaska, May 2003

No Action Alternative and Alternatives G2, G3, and G4

Neither the No Action Alternative nor the ferry alternatives would affect marine navigation or cruise ship operations in a way that would have a secondary impact on the local or regional economy.

Alternatives C3(a), C4, and F1 (Preferred)

Alternatives C3(a), C4, and F1 would have bridges with a 200-foot high vertical clearance and would allow continued use of the east channel by large cruise ships. All cruise ships currently sailing in Alaska would be able to pass under these proposed bridges, as well as those anticipated to sail to Alaska for the foreseeable future (see Sections 4.7.2.2 and 4.7.2.4). These bridge alternatives should have no discernible effect on cruise ship operations or related spending.

Alternatives C3(b) and D1

The 120-foot vertical clearance of these bridges would not allow the passage of large cruise ships. These bridge alternatives would have an adverse impact on cruise ship passenger activities and other revenues. In the analysis of direct impacts, eight fewer port calls would be expected as a result of implementing Alternatives C3(b) or D1 (see Section 4.7.2.3). Table 4-21 demonstrates the consequent potential reductions in revenue for the 2001 Base year.

TABLE 4-21
POTENTIAL ANNUAL CRUISE-RELATED SPENDING REDUCTIONS
WITH REDUCED PORT CALLS FOR ALTERNATIVES C3(B) AND D1

<i>Approach Direction</i>	<i>Port Calls (2001 Base Year)</i>	<i>Potential Reduction in 2001 Port Calls</i>	<i>Total Spending per Port Call</i>	<i>Potential Spending Reduction for 2001 Base Year</i>
Northbound Sailings	104	8	\$191,080	\$1,528,600
Southbound Sailings	281	0	\$191,080	\$0
Total	385	8	\$191,080	\$1,528,600

Source: DOT&PF, Gravina Access Project *Effects on Cruise Ship Operations*, prepared Klugherz & Associates/Northern Economics, Inc. under contract to HDR Alaska, May 2003

The analysis of direct impacts also determined that, for the remaining 377 port calls in 2001, there would be some reduction in the amount of time the ships would spend in port because of additional transit time necessary to bypass the bridges by navigating around Gravina Island.⁴⁷ To calculate potential reductions in passenger spending from reduced time in port, it was assumed that the last hour of spending for passengers calling at Ketchikan would be lost for northbound sailings only. (Northbound sailings cannot make up additional transit time; southbound sailings can.) The total reduction in passenger revenues was calculated by multiplying the average number of passengers per port call (1,662) by the number of port calls remaining for each usable port hour category by the amount associated with the last hour of spending. Table 4-22 presents the results of these calculations.

TABLE 4-22
POTENTIAL ANNUAL REDUCTIONS IN CRUISE SHIP PASSENGER SPENDING WITH REDUCED
PORT TIME FOR NORTH BOUND SAILINGS WITH ALTERNATIVES C3(B) AND D1

<i>Usable Port Time (hours)</i>	<i>Number of Port Calls</i>	<i>Amount Spent in Last Hour</i>	<i>Average Number of Passengers</i>	<i>Reduced Spending from Loss of Port Time (\$)</i>
< 4.0 hours	1	\$3.51	1664	5,834
4.0 hours	5	\$3.51	1664	29,168
5.0 hours	56	\$4.00	1664	372,288
6.0 hours	25	\$4.75	1664	197,363
> 7.0 hours	9	\$5.25	1664	78,530
Total	95			\$683,182

⁴⁷ The results of an analysis of transit time between Vancouver and Ketchikan demonstrated that nearly all ships have the capability to make up the additional transit time. Southbound vessels can make up the additional transit time required en route to Vancouver. Northbound vessels, while able to make up the time, would likely not do so en route to Ketchikan because they would arrive even earlier than the early morning schedules currently used, long before shops open or tours begin. Ships would not likely attempt to make up the time by reducing their time in Juneau or Skagway, the two primary ports of call when northbound from Ketchikan, since these two ports contribute more shore excursion revenues than Ketchikan. The remaining way to make up the time is to leave earlier from Ketchikan. Therefore, northbound ships would spend less time in port.

Table 4-23 summarizes the effects on passenger, crew and cruise line spending using the number of port calls in 2001 as the base year.

**TABLE 4-23
SUMMARY OF REDUCTION IN ANNUAL CRUISE-RELATED SPENDING
WITH ALTERNATIVES C3(B) AND D1 (2001 BASE YEAR)**

Total Spending Reduction from Fewer Port Calls	\$1,528,600
Spending Reduction from Fewer Hours in Port	\$683,100
Total Reduction in Cruise -Related Spending	\$2,211,700
Source: DOT&PF, Gravina Access Project <i>Effects on Cruise Ship Operations</i> , prepared by Klugherz & Associates/Northern Economics, Inc. under contract to HDR Alaska, May 2003	
Annual estimates presented in the Gravina Access Project Economic Impacts Assessment (Appendix D) apply these reduced spending estimates to the increasing number of cruise ships and cruise passengers in future years.	

Reductions in cruise-related spending arising from Alternatives C3(b) or D1 would have some additional negative effects on the Ketchikan economy. These effects are determined using the I-O model for Ketchikan. To estimate the consequences of the changes in spending, the estimates for total reductions in were used to measure the initial spending changes. The results of this analysis are shown in Table 4-24.

**TABLE 4-24
ANNUAL SECONDARY ECONOMIC EFFECTS FROM REDUCED
CRUISE-RELATED SPENDING WITH ALTERNATIVES C3(B) AND D1**

Reduction in Gross Regional Product (2003\$)	\$2,700,000
Reduction in total labor income, other property type income, and indirect business taxes (2003\$)	\$1,900,000
Employment Losses (Jobs)	60
Note: Estimated impacts include direct and secondary (indirect plus induced) effects	

Alternative F3

The analysis of direct impacts (see Section 4.7.2.5) determined that, based on 2001 cruise ship traffic, a total of 17 fewer port calls would be expected as a result of implementing Alternative F3 during the initial period of construction. After an adjustment period of roughly two years, eight fewer port calls are estimated as a result of implementing Alternative F3. Table 4-25 demonstrates the potential reduction in revenue resulting from fewer port calls with this alternative, assuming total spending per port call is \$191,080 (see Table 4-17).

**TABLE 4-25
POTENTIAL ANNUAL CRUISE-RELATED SPENDING REDUCTIONS
WITH ALTERNATIVE F3 (2001 BASE YEAR)**

<i>Approach Direction</i>	<i>Potential Reduction in Port Calls</i>	<i>Potential Spending Reduction</i>
During Initial Adjustment Period:		
Northbound Sailings	3	\$573,200
Southbound Sailings	14	\$2,675,100
Total	17	\$3,248,300
After Initial Adjustment Period:		
Northbound Sailings	2	\$381,200
Southbound Sailings	6	\$1,146,500
Total	8	\$1,527,700
Source: DOT&PF, Gravina Access Project <i>Effects on Cruise Ship Operations</i> , prepared by Klugherz & Associates/Northern Economics, Inc. under contract to HDR Alaska, May 2003		

An analysis of transit time between Vancouver and Ketchikan, and Ketchikan and Juneau determined that ships could make up the additional time needed to maneuver into and out of the Ketchikan port from West Channel. This analysis also determined that ships could make up any additional time necessary to transit around Gravina Island and enter or depart Ketchikan using the North Channel. Therefore, it was assumed that there would be no loss of port time, and therefore, no lost port spending for the remaining 368 port calls.

Reductions in cruise-related spending arising from Alternative F3 would have some additional, negative effects on the Ketchikan economy. These effects are determined using the I-O model for Ketchikan. In order to estimate the consequences of the changes in spending, the estimates for total reductions in spending were used to measure the initial spending changes. The results of this analysis are shown in Table 4-26.

**TABLE 4-26
ANNUAL SECONDARY ECONOMIC EFFECTS FROM REDUCED
CRUISE-RELATED SPENDING WITH ALTERNATIVE F3**

	<i>During Initial Adjustment Period</i>	<i>After Initial Adjustment Period</i>
Reduction in Gross Regional Product) (2003\$)	\$4,300,000	\$1,900,000
Reduction in total labor income, other property type income, and indirect business taxes (2003\$)	\$2,900,000	\$1,300,000
Employment Losses (Jobs)	90	40
Note: Estimated annual impacts include direct and secondary (indirect plus induced) effects		

4.26.3.5 Fiscal Impact on the Ketchikan Gateway Borough, City of Ketchikan, and City of Saxman

Property Tax Revenue

No Action Alternative

The No Action Alternative would have no impact on property tax revenues for the Borough, City of Ketchikan, and City of Saxman.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

Improved access to Gravina Island would result in increased property values on Gravina Island, thus generating greater property tax revenue from these properties for the Borough. Offsetting this effect, to at least some extent, would be probable decreases in property values on Revillagigedo Island as the availability of additional land on Gravina Island lessens demand for Revillagigedo Island land. The net effect on property tax revenue from this change in land value is uncertain.

Private lands and some structures would be acquired for each of the build alternatives. The assessed value of the private property (including structures) that might be acquired ranges from \$31,000 (Alternative F3) to \$4,140,000 (Alternative G3) (see Section 4.25.4). When the property is acquired it will be taken off of the tax rolls for the Borough, and if located within the City of Ketchikan, from the tax rolls in that government entity. None of the build alternatives are anticipated to require lands located within the City of Saxman. The conversion of private lands to public rights-of-way for Alternative G3, which has the highest acquisition cost, will reduce the assessed values, and associated property taxes, in the Borough by about four-tenths of 1 percent, and in the City of Ketchikan by about seven-tenths of 1 percent. Other alternatives would have lesser impacts than those calculated for Alternative G3.

Business and Sales Tax Revenues

No Action Alternative and Alternatives G, G3, and G4

The No Action Alternative and Alternatives G, G3, and G4 would have no impact on business and sales tax revenues for the Borough, City of Ketchikan, and City of Saxman.

Alternatives C3(a), C3(b), D1, F1 (Preferred), and F3

Bridge Alternatives C3(b), D1, and F3 would adversely affect businesses operating in the Borough, and resulting tax revenues to the Borough government, the City of Ketchikan, and the City of Saxman. The extent of the reduction would include reduced spending by vessel crew members, a lesser amount of ship expenditures while in port, and reduced spending associated with fewer flight-seeing charters, and other shore excursions. These spending reductions (see Table 4-25 and Table 4-26) would be less than 2 percent of total 2001 summer visitor expenditures (\$127,800,000) for Alternatives C3(b) and D1, and 2 percent and 1 percent for Alternative F3 during the initial period, and after the initial period, respectively. These percentages would be slightly lower (less than one-half of one percent lower) if measured against total annual visitor expenditures of \$151,800,000 (see Appendix D).

The Borough and the City of Ketchikan would experience reduced sales tax revenues as a result of lower spending levels. A previous study indicated that about 85 percent of cruise-related expenditures were taxable.⁴⁸ Assuming that this same percentage is applicable to total annual spending by other segments of the visitor industry, the spending reductions would result in sales tax revenues about one percent lower for the City of Ketchikan and the Borough with Alternatives C3(b), D1, and F3 during the initial adjustment period. This reduction would be about one-half of one percent for Alternative F3 after the initial adjustment period.

Tourism is estimated to account for almost \$293,000 (43 percent) of the \$682,000 general fund revenues for the City of Saxman.⁴⁹ These tourism-dependent revenues include fees charged to tour operators for visitors they bring to the totem park, sales at the city-owned Native Artist Cooperative Store, and sales tax revenues (excluding nontourism-dependent businesses). A reduction of less than 2 percent in total visitor-related revenues for the City would result in a reduction of less than 1 percent (about \$4,000) in total general fund revenues for Alternatives C3(b) and D1. Total general fund revenues would decrease by about 1 percent (\$6,000 for Alternative F3 during the initial period after vessels begin using West Channel, and about one-half of 1 percent (\$3,000) after the initial period.⁵⁰

The reduction in spending associated with changes or loss of the SVFR for the bridge alternatives (see Section 4.26.3.3) would also have an effect on sales tax revenues for the City of Ketchikan and the Borough. Changes in the SVFR are not anticipated to have a discernible effect on the City of Saxman. Table 4-27 shows the potential fiscal effect of the SVFR based on the assumptions noted in Section 4.26.3.3.

TABLE 4-27
FISCAL EFFECT OF CHANGES IN SVFR OPERATIONS ON LOCAL GOVERNMENT SALES TAX REVENUES

<i>Alternative/Local Government</i>	<i>Change in Sales Tax Revenue (\$)</i>
Alternatives C3(a), C3(b), C4, and D1	
Ketchikan Gateway Borough	(7,743)
City of Ketchikan	(13,550)
Alternative F1	
Ketchikan Gateway Borough	(1,549)
City of Ketchikan	(2,710)
Alternative F3	
Ketchikan Gateway Borough	(774)
City of Ketchikan	(1,355)

⁴⁸ *The Economic Impacts of the Cruise Industry in Southeast Alaska*, prepared for the Southeast Conference by the McDowell Group. October 2000.

⁴⁹ Bob Rubin, Administrator, City of Saxman, June 2002.

⁵⁰ The Saxman visitor industry businesses operate only during the summer season, so reductions in summer expenditures are used in this calculation.

4.26.3.6 Additional Infrastructure and Government Services

No Action Alternative

With the No Action Alternative, a greater portion of regional economic development can be expected to occur on Revillagigedo Island. Current development on the periphery of Ketchikan would likely continue. Such development would also require additional government services and infrastructure. Limited development is expected on Gravina Island in the future under the No Action Alternative so infrastructure requirements and needs for government services on the island would be limited.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

Development on Gravina or Pennock islands will primarily be a transfer of growth that would have otherwise occurred on Revillagigedo Island. As a result, the location of additional infrastructure and where government services are provided within the Borough will change but the total amount of such infrastructure and services will not be significantly affected.

With any of the build alternatives, development on Gravina Island would require infrastructure and government services. Again, these effects depend on the nature and scale of the development. For example, a high-density residential development would probably require street lighting and sewage services, whereas a low-density development would probably not. However, an expansion of police, fire, and other emergency services would almost certainly be necessary after there is a sufficient amount of residential development. Since the bridge alternatives would result in higher levels of development than the ferry alternatives, the provision of infrastructure and government services on Gravina Island would be required sooner with the bridge alternatives. The City of Ketchikan and the Borough would determine when those services would be provided in the future.

4.26.3.7 Regional Economic Development

No Action Alternative

Based on the medium economic growth forecast for the Borough summarized in *Ketchikan Gateway Borough Economic Forecasts*,⁵¹ the sectors of highest growth until 2025 are likely to be in the trade and services sector, which is driven primarily by tourism activity. Improvements in the AMHS and the recent development of the IFA are likely to attract shoppers and other visitors to Ketchikan from parts of southeast Alaska. Increases in tourism are expected because of the anticipated growth in cruise ship visits. Population in the Borough is predicted to grow slightly more than one percent annually during this period.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

Development of one of the build alternatives could shift some economic activity to Gravina Island. In particular, anticipated population growth of just slightly higher than one percent annually suggests that some expansion of local housing would occur. If additional land on Gravina Island were available for residential development, then a bridge would probably result

⁵¹ DOT&PF, *Gravina Access Project, Ketchikan Gateway Borough Economic Forecasts Technical Memorandum*, prepared by Northern Economics under contract to HDR Alaska, August 2002.

in more interest in Gravina Island housing than improved ferry service because of the greater convenience that a bridge offers. However, even with expanded ferry service or a bridge alternative, most of the additional housing required by a growing Borough population would probably be located on Revillagigedo Island. It is important to note that development of additional roads and other infrastructure by the Borough will be necessary to achieve more than very modest levels of economic development on Gravina Island by 2025. Without the Borough support for expansion of the road network and utility availability on the island, development would be constrained.

In addition, a bridge or improved ferry, along with the availability of additional land on Gravina Island, would be likely to lower regional land prices and housing costs or, at least, slow their rate of increase over time in the Borough.⁵² Lower housing costs might stimulate some purchases that would not otherwise be made. This effect on housing costs is certainly beneficial to potential buyers. However, each market transaction requires a seller, too, and landowners would receive lower prices when selling their properties.

Table 4-28 shows several indicators of the level of economic development on Gravina and Pennock Islands that might be achieved with the project alternatives (as compared with the No Action Alternative) with a medium level of economic activity in the region. As noted previously, much of the growth on Gravina or Pennock Islands represents a transfer of development that would have occurred on Revillagigedo Island. The indicators presented here represent the area, population, or employment that would be served by the Gravina Access Project. It is anticipated that development would also occur in areas outside of the areas of influence of the Gravina Access Project; such development is not included here.

⁵² The magnitude of the effect on land prices would depend, in part, on how much additional land becomes available. Although, overall, regional land prices are likely to fall, initially, land prices on Gravina Island would be expected to rise. At present, there are no clear indications how Gravina Island property owners might react to higher prices, thus there are no indications of the amount of land that might be made available.

TABLE 4-28
REGIONAL ECONOMIC DEVELOPMENT IN GRAVINA ACCESS PROJECT SERVICE AREA

Category	Additional Development			
	No Action Alternative	Alternatives G2, G3, and G4	Alternatives C3(a), C3(b), C4, and D1)	Alternatives F1 and F3
Land Use Served (Acres) ¹ :				
Gravina Island	20	73	310	406
Pennock Island (F1 and F3 only)	0	0	0	76
Total ²	20	73	310	482
Population Served: ²				
Gravina Island	40	130	730	980
Pennock Island (F1 and F3 only)	0	0	0	190
Total	40	130	730	1,170
Employment:				
Gravina Island	10	50	50	60
Pennock Island (F1 and F3 only)	0	0	0	<10
Total ²	10	50	50	<70

¹ Acres of land served by the Gravina Access Project alternatives; other development may occur beyond the area of influence of the Gravina Access Project but such lands would continue to be accessed by private vessels and other means.

² Permanent, year-round residents that are served by the Gravina Access Project alternatives; residents of Gravina or Pennock Islands living beyond the anticipated road network are not counted in the population estimate with a bridge alternative, a large population is expected to have seasonal or second homes on Gravina Island.

4.26.3.8 User Benefits

The benefits to users of the Gravina Access Project alternatives arise in two principal categories: those associated with existing trips, and those associated with new demand for trips. The first category includes potential time-savings for existing trips and the improved standard of living and productivity gains associated with those savings. In addition, current travelers might realize a change in out-of-pocket costs such as tolls (also addressed in Sections 4.5 and 4.26.3) and vehicle operating costs, and, statistically, a change in accident probability rates due to a shift from one mode or level of service to another.

Benefits in the second principal category arise in the form of additional trips to and from Gravina Island by travelers for whom the costs and inconvenience of access under the existing ferry system are outweighed by the value of opportunities (e.g., existing draws such as shops, work places, and social and recreational activities) on Revillagigedo Island. With potential development induced by the Gravina Access Project, opportunities such as new retail outlets can emerge in response to the new cost-to-value travel equation, leading to additional demand for travel between Gravina and Revillagigedo Islands. The new opportunities can be followed by or led by new residential and workplace development.

Table 4-29 provides a summary of the user benefits associated with each alternative. Existing and new trip benefits can be offset by environmental impacts. For purposes of this analysis,

environmental costs (shown as a negative environmental benefits) are based on annual emissions calculated per vehicle mile traveled for each of the alternatives (see Appendix D).

TABLE 4-29
USER ECONOMIC BENEFITS OF GRAVINA ACCESS PROJECT ALTERNATIVES
2003-2025 (MILLIONS OF 2003 \$)

	Airport Bridge				Pennock Island Bridge		Enhanced Ferry Service		
	C3(a)	C3(b)	C4	D1	F1	F3	G2	G3	G4
Existing Trips ¹									
Travel Time Savings	\$19.70	\$22.60	\$22.90	\$23.60	\$9.50	\$6.90	\$0.00	\$0.00	\$2.20
Out-of-Pocket Cost Savings	\$17.00	\$18.20	\$18.50	\$20.10	\$8.80	\$8.90	\$0.00	\$0.00	(\$0.10)
Accident Cost Savings	(\$3.50)	(\$3.00)	(\$2.90)	(\$2.20)	(\$7.00)	(\$6.90)	\$0.00	\$0.00	\$0.00
Existing Trip Benefits	\$33.20	\$37.80	\$38.40	\$41.50	\$11.20	\$9.00	\$0.00	\$0.00	\$2.10
New Trip Benefits ²	\$22.90	\$25.40	\$26.60	\$29.10	\$17.50	\$15.20	\$0.00	\$0.00	\$0.00
Total Consumer Surplus	\$56.10	\$63.20	\$65.00	\$70.60	\$28.70	\$24.20	\$0.00	\$0.00	\$2.10
Environmental Benefits ³	(\$0.90)	(\$0.80)	(\$0.80)	(\$0.60)	(\$1.60)	(\$1.60)	(\$0.20)	(\$0.20)	(\$0.20)
Total Project Benefits ⁴	\$55.20	\$62.30	\$64.20	\$70.00	\$27.10	\$22.60	(\$0.20)	(\$0.20)	\$2.00

Note: Numbers in parentheses represent negative values.

¹ Existing trip benefits are based on forecasts of passenger trips under the No Action Alternative.

² New trips are trips induced by improved access; i.e., trips that occur as a result of growth and development associated with the build alternative.

³ Environmental benefits (costs are defined as negative benefits) are the costs that result from vehicle use, emissions, and vehicle-generated noise. For more information, see Appendix D.

⁴ Project benefits are calculated based on the traffic projections discussed in Section 4.26.4.3. For more information, see Appendix D.

No Action Alternative

User benefits are calculated as the change from the No Action Alternative, so by definition the No Action alternative would not have any impacts.

Alternatives C3(a), C3(b), C4, and D1

For the bridge alternatives located near the airport, the majority of the benefits are related to user benefits realized from existing trips as these alternatives provide for shorter trip times and ferry toll savings for users.⁵³ The benefits realized from new demand are also very significant for similar reasons but are less than that from existing trips. A slight offset to these user benefits is the increased emission costs due to increased roadway vehicle use. Overall the bridge alternatives nearest the airport provide the greatest user benefits with total benefits in the range of \$55-\$70 million.

⁵³ DOT&PF, *Gravina Access Project, Quantification of User Economic Benefits Technical Memorandum*, prepared by HLB Decision Economics, Inc. under contract to HDR Alaska, November 2002.

Alternatives F1 (Preferred) and F3

The user benefits from the bridge alternatives that cross Pennock Island are primarily derived from new trips to developable lands. Benefits related to existing trips are relatively small in comparison to the bridge alternatives located near the airport as more roadway travel is required and the time savings are less. In total, the user benefits of the Pennock Island crossing option are less than 40 percent of that provided by Alternatives C3(a, b), C4, and D1.

Alternatives G2, G3, and G4

The longer transit time for ferries between Gravina and Revillagigedo Islands for Alternatives G2 and G3 offsets any potential time savings from the Revillagigedo Island ferry terminals being in closer proximity to the origin. More frequent service under Alternative G4 results in benefits that are greater than the other improved ferry alternatives but much smaller than the bridge alternatives.

4.26.4 Transportation Impacts

4.26.4.1 Aviation Impacts

No Action Alternative

The No Action Alternative would have no secondary impacts on aviation.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

The only secondary impacts to aviation potentially resulting from the Gravina Access Project alternatives are related to Ketchikan International Airport. None of the build alternatives would have adverse secondary impacts on planned airport facilities. The Airport Master Plan⁵⁴ calls for upgrading the Runway Safety Area (RSA) by shifting the runway 800 feet to the southeast. This shift would create 1,000 feet of RSA at the northwestern end and 1,000 feet of RSA beyond the shifted runway at the southeastern end. The proposed alternatives and associated roadways would not affect implementation of these plans.

The airport circulation road would be aligned to traverse to the south end of the existing RSA, through the area of the planned RSA extension. This would bring the road through the current runway protection zone, but outside the current RSA. The road would be approximately 45 feet below the existing runway surface, well below the approach surface to Runway 29. Such an alignment would have no secondary impact on current airport operations. The planned runway extension would occur over the top of the roadway, at which time the roadway would be placed in a cut-and-cover tunnel, thereby avoiding impacts on the runway or the RSA.

Adverse secondary impacts on the airport terminal parking would result from the anticipated increase in the number of vehicles driving to and parking at the airport after access is improved. The traffic projections associated with these alternatives (see Table 4-30) indicate a need for additional parking facilities at the airport by 2025. A parking structure is included in the Airport Master Plan as an option to be coordinated with the Gravina Access Project, which would mitigate the adverse impact associated with the increase in need for airport parking (see

⁵⁴ DOT&PF. *Ketchikan International Airport Master Plan Draft Final Report*. November 2002.

Mitigation below). Adding a parking structure at the airport terminal would be a benefit to the airport because it would functionally separate the parking facilities from the terminal, and thus improve airport security. In addition, shifting the airport parking area from its waterfront location in Ketchikan to Gravina Island would free up the waterfront land for other uses.

Development of the airport circulation road could raise the grade near the current general aviation apron, thereby creating additional usable space for airport use in that location. The airport circulation road to the southwest side of the airport would provide additional opportunity for future airport expansion and apron and taxiway development. The ability to shift airport development to the southwest side of the airport over the long term could free up existing waterfront area for water-dependent development, which represents a benefit to the airport facilities.

Mitigation

The Airport Master Plan includes provisions for a 300-space, three-story parking structure near the terminal area, with roads and walkways for vehicles and pedestrians to enter and exit the structure. Pedestrian access to short-term parking, drop-off lanes, and long-term parking will be required. Access and circulation in and around the airport terminal area will be accommodated in much the same way as it is currently provided. The airport layout plans will need to be updated and approved to reflect the ultimate location of the parking structure. The parking structure will have a beneficial impact on pedestrians: pedestrians will have all-weather access between the parking structure, the floatplane dock, and the airport terminal building that is not only enclosed, but also accessible in accordance with the Americans with Disabilities Act. Currently, pedestrian access from the ferry and floatplane landings to the terminal is neither accessible to those with disabilities nor enclosed.

4.26.4.2 Marine Navigation Impacts

No Action Alternative

The No Action Alternative would have no secondary impacts on marine navigation.

Alternatives C3(b), D1, G2, G3 and G4

The secondary impacts associated with these alternatives are related to the economic effects of changes in operations of cruise ships and other vessels. Alternatives C3(b), D1, G2, G3 and G4 would have no other secondary impacts on marine transportation. Section 4.26.3 (Secondary Impacts) describes the economic impacts that would result from the direct impacts on marine transportation.

Alternatives C3(a), C4, F1 (Preferred), and F3

The secondary impacts associated with Alternatives C3(a), C4, F1, and F3 are related primarily related to the economic effects of changes in operations of cruise ships and other vessels. Section 4.26.3 (Secondary Impacts) describes the economic impacts that would result from the direct impacts on marine transportation. These bridge alternatives would also have long-term secondary effects because of increased risk associated with transiting under a bridge, scheduling requirements for large ships passing under the bridge, and the requirement for one-way traffic in Tongass Narrows for the lifetime of the bridge.

4.26.4.3 Vehicle Impacts

The secondary effects of the Gravina Access Project on vehicular traffic are based on traffic projections for 2025 (Table 4-30). The analysis examined 12 existing study area intersections on Tongass Avenue between Bryant Street, which is approximately 0.5 mile south of the airport ferry terminal site, and Deermount Street, which is approximately 0.3 mile south of downtown Ketchikan, as well as the intersections with the approaches to each of the alternatives (see Figure 3.14).

TABLE 4-30
TRAFFIC PROJECTIONS: ONE-WAY TRIPS ACROSS TONGASS NARROWS

<i>Alternative</i>	<i>People per Day in 2025</i>
C3(a), C3(b), C4, and D1	4,300
F1 and F3	5,100
G2, G3, and G4	1,600
No Action	1,350
Reference	There were 1,056 passenger trips per day on the ferry in 1999.

Source: The reference number of 1,056 passenger trips per day is from *Ketchikan 2020 & Gravina Access Project: Existing Conditions Demographic and Socioeconomic Analysis*, and forecast numbers are from the Economic Impact Assessment (Appendix D).

The traffic analysis characterized the effects of the project alternatives on the Level of Service (LOS) of the 12 study area intersections and the approaches to the alternatives. The analysis was conducted for the afternoon peak hour, as this time period places the greatest demands on the roadway system. Intersections with a LOS E or F are considered to be have traffic impacts deemed “unacceptable” from a traffic engineering perspective.

Traffic projections and the LOS analysis for the No Action Alternative represent background traffic conditions for 2025. Based on traffic projections associated with the ferry alternatives (Alternatives G2, G3, and G4), these alternatives would not significantly affect the background traffic conditions on the local roadway system; therefore, LOS was calculated only for the intersections associated with the new and existing ferry terminal access drive for these alternatives. Table 4-31 provides the projected LOS for the No Action Alternatives and the bridge alternatives (Alternatives C3[a,], C4, D1, F1, and F3) at the analyzed intersections. Table 4-32 provides the projected LOS for the ferry alternatives where the ferry terminal access drives intersect Tongass Avenue. Note that the *Highway Capacity Manual* methodology provides a composite LOS for signalized intersections and the LOS for each minor move (individual approaches) at unsignalized intersections.

TABLE 4-31
LEVEL OF SERVICE AT PROJECT AREA INTERSECTIONS-NO ACTION AND BRIDGE
ALTERNATIVES (PROJECTIONS FOR 2025 ASSUMING MEDIUM ECONOMIC GROWTH)

<i>Intersection with Tongass Avenue (Type of Control)*</i>	<i>No Action</i>		<i>C3(a)/C3(b)/C4/D1</i>		<i>F1/F3</i>	
	<i>LOS</i>	<i>Delay (seconds)</i>	<i>LOS</i>	<i>Delay (seconds)</i>	<i>LOS</i>	<i>Delay (seconds)</i>
Deermount Street (Stop)						
EBL	A	9.1	A	9.2	A	9.7
SBL	F	55.2	F	72.3	F	142.4
SBR	B	14.2	C	15.0	C	17.1
Bawden Street (Stop)						
NBL	A	8.5	A	8.6	A	8.9
SBLR	A	9.1	A	9.4	A	9.6
WBLR	F	209.1	F	344.1	F	557.4
EBL	F	112.4	F	172.0	F	327.0
EBR	C	24.7	D	28.7	E	37.0
Main Street (Stop)						
NBL	A	8.8	A	9.0	A	9.3
SBLR	A	8.4	A	8.6	A	8.7
WBLR	D	26.7	D	34.6	E	45.1
EBLR	E	40.1	F	54.3	F	87.0
Mission Street (Stop)						
NBL	B	11.5	B	12.1	B	12.8
Dock Street (Signal)	A	5.1	A	5.2	A	5.4
Schoenbar Road (Stop)						
EBL	C	18.5	C	20.2	C	21.4
WBL	B	11.0	B	11.4	B	11.5
NBLR	F	**	F	**	F	**
SBL	F	**	F	**	F	**
SBR	F	169.2	F	224.8	F	249.1
Washington Street (Signal)	A	9.4	B	10.3	B	11.1
Jefferson Street (Signal)	B	16.8	B	18.2	B	18.5
Third Avenue (Stop)						
EBL	B	13.7	B	14.8	B	14.3
SBL	F	261.5	F	401.7	F	330.7
SBR	C	15.3	C	16.5	C	15.9
Carlanna Lake Road (Signal)	E	57.3	E	68.7	E	68.7
Bryant Street (Stop)						
EBL	A	10.0	B	10.5	B	10.2
SBL	F	168.5	F	326.9	F	305.2
SBR	C	17.5	C	20.4	C	18.4
Airport Ferry Access Drive (Stop)						
WBL	B	10.8	X	X	X	X
NBLR	F	91.6				
C3(a)/C3(b)/C4/D1 Access						
EBL	X	X	B	10.6	X	X
SBLR			F	986.0		
F1 Access						
EBL	X	X	X	X	A	9.5
SBLR					F	87.2
F3 Access						
WBL	X	X	X	X	A	9.9
NBL					F	321.2

* Direction of Movement: NB = Northbound, SB = southbound, EB = Eastbound, WB = Westbound, L = left turn movement, R = right turn movement, LR = left and right turn movements. ** Delay greater than 1,000 seconds per vehicle. X intersection does not exist in this alternative

TABLE 4-32
LEVEL OF SERVICE AT PROJECT AREA INTERSECTIONS-FERRY ALTERNATIVES
(PROJECTIONS FOR 2025 ASSUMING MEDIUM ECONOMIC GROWTH)

Intersection with Tongass Avenue (Type of Control)*	G2		G3		G4	
	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Jefferson Street (Signal) G3 Access	NA	NA	C	22.9	NA	NA
Existing Airport Ferry Access Drive (Stop)						
WBL	B	10.6	B	10.3	B	10.9
NBLR	D	26.1	E	38.5	F	125.9
G2 Access (Stop)						
WBL	B	10.3	X	X	X	X
NBLR	D	29.5				

* Direction of Movement: NB = Northbound, WB = Westbound, L = left turn movement, R = right turn movement, LR = left and right turn movements

NA Not analyzed

X intersection does not exist in this alternative

No Action Alternative

Traffic projections show that, under the No Action Alternative, the LOS would decrease from existing acceptable levels to unacceptable levels (i.e., E or F), resulting in corresponding traffic congestion and vehicle delays, for one or more turning movements at the following seven project area intersections:

- ◆ Deermount Street and Stedman Street/Tongass Avenue
- ◆ Bawden Street and Front Street/Tongass Avenue
- ◆ Main Street and Front Street/Tongass Avenue
- ◆ Schoenbar Road and Tongass Avenue
- ◆ Carlanna Lake Road and Tongass Avenue
- ◆ Bryant Street and Tongass Avenue
- ◆ Airport ferry access drive and Tongass Avenue

These intersections would require traffic signal operation in order to attain acceptable traffic conditions. With the exception of Third Avenue southbound left turn movement, traffic at the remaining five intersections included in the analysis would not be affected by future (2025) traffic conditions because the length of delay would not increase by more than a few seconds and the intersections would continue to operate at LOS C or better. The Third Avenue southbound left turn movement would continue to operate at LOS F and the delay would increase from 65 seconds (existing) to approximately 262 seconds (2025). This result, however, is due to an anomaly in the analysis methodology that allows a single left turn to disproportionately affect delay. The projected number of left turns is limited to one for all analysis cases. As such, improvements were not investigated at this location.

Alternatives C3(a), C3(b), C4, and D1

The intersections of Alternatives C3(a), C3(b), C4, and D1 with Tongass Avenue would operate at unacceptable levels (i.e., LOS F) for turning movements from the alternative alignment onto

Tongass Avenue. Vehicle travel between the alignments and Tongass Avenue would be adversely affected by long delays.

A traffic signal would be installed at the Alternative C3(a)/C3(b)/C4/D1 intersection with Tongass Avenue to reduce traffic congestion and vehicle delays and restore operating conditions to acceptable levels of service. It is also likely that pedestrian signals will be required as part of the signal installation. The traffic signal itself would cause some off-peak traffic delays. However, if no signal were installed, the additional peak hour traffic expected by 2025 would delay traffic even more and exacerbate LOS problems.

The LOS at the intersections of Tongass Avenue with Deermount Street, Bawden Street, Main Street, Washington Street, and Bryant Street would be adversely affected for certain turning motions by 2025. These intersections would be closely monitored, and a corrective action (e.g., installation of traffic signals) would be taken to avoid any reduction in LOS.

Alternatives F1 (Preferred) and F3

The intersections of Alternatives F1 and F3 with South Tongass Highway would operate at unacceptable levels (i.e., LOS F) for turning movements at the alternatives' intersection with South Tongass Highway. Vehicle travel between the alignments and South Tongass Highway would be adversely affected by long delays.

A traffic signal would be installed at the Alternatives F1 and F3 access to South Tongass Highway to reduce traffic congestion and vehicle delays and restore operating conditions to acceptable levels of service. It is also likely that pedestrian signals will be required as part of the signal installation. The traffic signal itself would cause some off-peak traffic delays. However, if no signal were installed, the additional peak hour traffic expected by 2025 would delay traffic even more and exacerbate LOS problems.

The LOS at the intersections of Tongass Avenue with Bawden Street, Main Street, Washington Street, and Bryant Street would be adversely affected for certain turning motions by 2025. These intersections would be closely monitored, and a corrective action (e.g., installation of traffic signals) would be taken to avoid any reduction in LOS.

Alternative G2

Alternative G2 would not cause unacceptable LOS at any project area intersections beyond future background levels. Both the existing airport ferry access drive and the Peninsula Point ferry access drive would operate at LOS D. Background traffic levels resulting in unacceptable LOS at the intersections of Tongass Avenue with Deermount Street, Bawden Street, Main Street, Schoenbar Road, Carlanna Lake Road, and Bryant Street would not be affected by Alternative G2. The new ferry terminal at Peninsula Point would reduce traffic at the existing airport ferry access drive, and improve the LOS to an acceptable level (D) as compared with the background level (F). This alternative would therefore have a beneficial effect on traffic.

Alternative G3

Alternative G3 would not cause unacceptable LOS at any project area intersections beyond future background levels. Turning movements onto Tongass Avenue from the existing airport ferry access drive would experience delay at LOS E, which would be an improvement compared

with the background level (F), but would still be unacceptable. The new ferry access drive at Jefferson Street would operate at LOS C. Background traffic levels resulting in unacceptable LOS at the intersections of Tongass Avenue with Deermount Street, Bawden Street, Main Street, Schoenbar Road, Carlanna Lake Road, and Bryant Street would not be affected by Alternative G3.

Installation of a traffic signal at the existing airport ferry access drive is recommended to reduce traffic congestion and vehicle delays and restore operating conditions to acceptable levels of service. It is also likely that pedestrian signals will be required as part of the signal installation.

The traffic signal itself would cause some off-peak traffic delays. However, if no signal were installed, the additional peak-hour traffic expected by 2025 would delay traffic even more and exacerbate LOS problems.

Alternative G4

Alternative G4 would not cause unacceptable LOS at any project area intersections beyond future background levels. Turning movements onto Tongass Avenue from the existing airport ferry access drive would experience delay at LOS F, the same LOS anticipated for future background levels. The LOS at this intersection would be unacceptable. Background traffic levels resulting in unacceptable LOS at the intersections of Tongass Avenue with Deermount Street, Bawden Street, Main Street, Schoenbar Road, Carlanna Lake Road, and Bryant Street would not be affected by Alternative G4.

Installation of a traffic signal at the existing airport ferry access drive is recommended to reduce traffic congestion and vehicle delays and restore operating conditions to acceptable levels of service. It is also likely that pedestrian signals will be required as part of the signal installation.

The traffic signal itself would cause some off-peak traffic delays. However, if no signal were installed, the additional peak hour traffic expected by 2025 would delay traffic even more and exacerbate LOS problems.

4.26.5 Pedestrians and Bicyclists

4.26.5.1 No Action Alternative

As a result of expected traffic increases not related to the project, traffic signal operation would be required at seven project area intersections in order to attain acceptable traffic conditions. These intersections are:

- ◆ Deermount Street and Stedman Street/Tongass Avenue
- ◆ Bawden Street and Front Street/Tongass Avenue
- ◆ Main Street and Front Street/Tongass Avenue
- ◆ Schoenbar Road and Tongass Avenue
- ◆ Carlanna Lake Road and Tongass Avenue
- ◆ Bryant Street and Tongass Avenue
- ◆ Existing ferry terminal and Tongass Avenue

Each of these intersections would be expected to include pedestrian phasing, which would increase pedestrian and bicyclist safety over existing conditions with no traffic signals.

4.26.5.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), and F3

The new intersection formed by the bridge intersection with Tongass Avenue would require traffic signal operation to achieve acceptable conditions considering the projected traffic levels. In addition to the other intersections requiring traffic signals for the No Action Alternative, the new intersection would be equipped with pedestrian signals, providing another safe crossing of Tongass Avenue for pedestrians and bicyclists.

4.26.5.3 Alternatives G2 and G3

The new intersection formed by the intersection of the new ferry terminal access drive with Tongass Avenue would operate at acceptable levels under projected traffic conditions; therefore, no new traffic signal on Tongass Avenue would be required. There would be no pedestrian signals and no additional safe crossing of Tongass Avenue for pedestrians and bicyclists.

4.26.5.4 Alternative G4

The existing intersection formed by the ferry terminal access drive with Tongass Avenue would operate at acceptable levels under projected traffic conditions; therefore, no new traffic signal on Tongass Avenue would be required. There would be no pedestrian signals and no additional safe crossing of Tongass Avenue for pedestrians and bicyclists.

4.26.6 Air Quality Impacts

Increased vehicular traffic associated with the project would increase emissions of particulate matter smaller than 10 microns in diameter (PM₁₀) and carbon monoxide (CO); however, because the project area has always been in attainment with respect to the NAAQS and because the projections for increased traffic volumes associated with the Gravina Access Project alternatives would be less than 3,000 vehicles per hour (assuming medium economic growth), no air quality conformity analysis or detailed modeling is required. The methodology for determining secondary air quality impacts of the project is described in Appendix Q.

4.26.6.1 Particulate Matter

FHWA recommended that a qualitative analysis of future PM₁₀ levels be conducted to determine if the projected traffic levels associated with the project alternatives could result in an exceedance of the NAAQS for PM₁₀⁵⁵ (i.e., a 24-hour average of 150 micrograms per cubic meter⁵⁶ or an annual average of 50 micrograms per cubic meter).

To determine if the project alternatives could result in an exceedance of the NAAQS for PM₁₀, the project team referred to suggestions found in the FHWA publication, *Guidance for*

⁵⁵ Jeff Houk, Air Quality Specialist, FHWA Western Resource Center, e-mail correspondence to C. Snead, HDR Environmental Planner. October 23, 2002.

⁵⁶ The 24-hour average for PM₁₀ is based on the highest (maximum) and second highest (second maximum) recorded concentrations at a given receptor, allowing for one exceedance of the standard per year at any receptor.

*Qualitative Project Level “Hot Spot” Analysis in PM-10 Nonattainment and Maintenance Areas*⁵⁷. The analysis involved identifying an area with similar traffic and air quality conditions to the project area and where monitoring data for PM₁₀ is available, and making a comparison of PM₁₀ concentration based on traffic levels. The PM₁₀ monitoring location that most closely represents traffic and air quality conditions of the Gravina Access Project area is located in Juneau, Alaska, at Floyd Dryden Junior High School (Dryden) on Mendenhall Loop Road. The traffic volumes at this location in 2000 were 1,201 vehicles during the peak hour⁵⁸. The PM₁₀ levels at Dryden show a downward trend since 1996, with concentrations falling to less than 20 percent of standards by 2001 (see Table 4-33). The monitoring values for all years are well below the NAAQS for PM₁₀.

TABLE 4-33
PM₁₀ CONCENTRATIONS AT DRYDEN MONITORING STATION, JUNEAU, ALASKA

Year	Number of Daily Observations	24-Hour Values (µg/m ³)		Annual Average (µg/m ³)	
		Observed Maximum/Second Maximum	NAAQS	Observed	NAAQS
1996	273	86/79	150	15.3	50
1997	199	70/63	150	10.7	50
1998	75	48/40	150	10.6	50
1999	113	28/27	150	6.6	50
2000	96	33/27	150	7.5	50
2001	91	28/24	150	6.1	50

Source: EPA online database: <http://www.epa.gov/air/data/index.html>

Traffic levels associated with the Gravina Access Project alternatives indicate that, under medium economic growth, the highest peak hourly volume resulting from any of the project alternatives in 2025 would be 2,648 vehicles on Tongass Avenue between Carlanna Lake Drive and Third Avenue. This is approximately 2.2 times higher than the 1,201 vehicles for the peak hour at Dryden in 2000. Therefore, a multiplier of 2.2 was applied to the 2000 PM₁₀ data at Dryden to estimate worst-case PM₁₀ emissions for the Gravina Access Project (µg/m³ = micrograms per cubic meter):

$$\begin{aligned} \text{24-hour Value:} & \quad 33 \mu\text{g/m}^3 \times 2.2 = 72.6 \mu\text{g/m}^3 \\ \text{Annual:} & \quad 7.5 \mu\text{g/m}^3 \times 2.2 = 16.5 \mu\text{g/m}^3 \end{aligned}$$

These estimates indicate that, with any of the project alternatives, the PM₁₀ concentrations would be less than half of both the NAAQS 24-hour and annual averages. Because paved roads generally contribute to only a small fraction of the total PM₁₀ concentration at any location (the majority is anticipated to be caused by other sources such as fuel combustion and sea salt in this coastal region), an increase in traffic on paved roads will not mean a proportionate increase in PM₁₀ concentrations. Therefore, none of the project alternatives would cause or contribute to violations of the NAAQS for PM₁₀.

⁵⁷ FHWA Office of Natural Environment, September 2001.

⁵⁸ Rick Purves, Traffic Engineer, DOT&PF, personal communication with S. Zilka, HDR Air Quality Specialist, October 2002.

4.26.6.2 Carbon Monoxide

Based on a comparison of air quality conditions in Juneau, Alaska, the traffic projections associated with the project alternatives would not result in exceedances of NAAQS for CO in the Ketchikan area. With a similar climate and a larger population (over 30,000), Juneau has no reported exceedances of CO. With continued improvement in automobile engineering to reduce CO emissions, ambient CO concentrations would continue to decline. Traffic projections associated with the Gravina Access Project would not affect ambient concentrations of CO.

4.26.7 Noise Impacts

Secondary noise impacts are associated with construction of new residential, commercial, and industrial developments; long-term operations at industrial and commercial sites; and vehicular travel associated with the new land uses. Construction-related noise would be restricted by local ordinance consistent with City of Ketchikan requirements. Noise from commercial and industrial sources would be limited to development zones specifically intended for such uses; therefore, the nearby land uses would not be expected to be sensitive to noise emanating from these sources.

In accordance with FHWA noise regulations (23 CFR Part 772) and DOT&PF Noise Abatement Policy (March 1996), an evaluation was conducted to determine the noise impacts associated with traffic patterns resulting from the proposed alternative alignments and the No Action Alternative.

Noise levels associated with traffic projected to occur in 2025 with each of the alternatives were determined by using the FHWA Traffic Noise Model Version 2.0. The basic model inputs are:

- ◆ Afternoon peak hourly traffic volumes for 2025 assuming medium economic growth and development;⁵⁹
- ◆ A proposed fleet mix for vehicle travel north of Dock Street of 92.0 percent Autos, 6.2 percent Medium Trucks, 0.4 percent Heavy Trucks, 1.3 percent Buses, and 0.13 percent Motorcycles.⁶⁰
- ◆ A proposed fleet mix for vehicle travel south of Dock Street of 93.7 percent Autos, 4.0 percent Medium Trucks, 0.4 percent Heavy Trucks, 1.8 percent Buses, and 0.1 percent Motorcycles.⁶¹
- ◆ Operational speed of 25 mph for Tongass Avenue north of Schoenbar Road and 20 mph for Tongass Avenue from Schoenbar Road to Deermount Avenue (a.k.a. Mill Street and Stedman Street);
- ◆ Operational speed of 45 mph along the alternative roadway and, where applicable, bridges;

The FHWA Traffic Noise Model defaults for options such as meteorological conditions and pavement type (i.e., 50 percent humidity, 68°F, average pavement type).

⁵⁹ DOT&PF, *Gravina Access Project Traffic Assessment Technical Memorandum*, prepared by HDR Alaska, Inc. November 2002.

⁶⁰ Vehicle mix provided by Rick Purves, DOT&PF Traffic Engineer, to C. Snead, HDR, May 21, 2003.

⁶¹ Ibid.

Traffic noise levels were determined at various distances from the centerline of the modeled segments of Tongass Avenue, Mill Street, and Stedman Street, and of the alternatives and roadways approaching the alternatives. The results of this analysis provide the distances from centerline at which the noise levels approach the Noise Abatement Criteria (NAC) for Activity Category B or C⁶²; i.e., where the noise level is within 1 dB(A) of the NAC for those activity categories, or 66 dB(A) and 71 dB(A), respectively (see Table 3-18). For all alternatives, including No Action, the distance from centerline within which noise impacts would occur would expand from current conditions (see Table 3-20) as a result of increased traffic projected to occur along these roadways. For purposes of this analysis, impacts of the build alternatives on noise levels along Tongass Avenue are described relative to the No Action Alternative.

4.26.7.1 No Action Alternative

As shown in Table 4-34, the distance from the centerline of Tongass Avenue to the most sensitive noise impact threshold (i.e., 66 dB[A]) ranges from 31 feet to 64 feet in the study area under the No Action Alternative during the peak hour of traffic volume. Noise levels would be greatest in the area between Carlanna Lake Drive and Dock Street. The increased traffic associated with the No Action Alternative would result in increased noise levels on Tongass Avenue that would effectively widen the impact area by 12 to 28 feet (i.e., 6 to 143 feet on either side of centerline), as compared to existing conditions (see Table 3-20).

TABLE 4-34
DISTANCE FROM CENTERLINE TO NOISE IMPACT THRESHOLDS
FOR NO ACTION ALTERNATIVE

Segment	PHV ¹ (2025)	Distance to Traffic Noise Impact Threshold (feet)	
		66 dB(A) ²	71 dB(A) ³
North Tongass Ave. to Ferry Terminal Access Drive	1768	53	26
Ferry Terminal Access Drive to Bryant Street	1822	54	27
Bryant Street to Carlanna Lake Dr.	1786	53	26
Carlanna Lake Dr. to Third Ave.	2462	58	32
Third Ave. to Jefferson St.	2410	57	32
Jefferson St. to Washington St.	2250	62	31
Washington St. to Schoenbar Rd.	2341	64	31
Schoenbar Rd. to Dock St.	2309	54	27
Dock St. to Mission St.	1635	40	20
Mission St. to Main Street	1381	36	18
Main Street to Bawden Street	1083	31	15
Bawden Street to Deermount Street	1283	36	17
Deermount Street to South Tongass Highway	1164	34	16

¹ Peak Hourly Volume

² 66 dB(A) is 1 dB(A) less than the NAC for Activity Category B

³ 71 dB(A) is 1 dB(A) less than the NAC for Activity Category C

⁶² Activity Category B includes picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals. Activity Category C includes other developed lands, properties, or activities not included in Category B and not including lands on which serenity and quiet are of extraordinary significance or that serve an important public need where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.

4.26.7.2 Alternatives C3(a), C3(b), C4 and D1

As shown in Table 4-35, the distance from the centerline of Tongass Avenue to the most sensitive noise impact threshold ranges from 33 feet to 60 feet in the study area under Alternatives C3(a), C3(b), C4, and D1 during the peak hour of traffic volume. Noise levels would be greatest in the area between the north end of the study area and Dock Street. The increased traffic associated with these alternatives on Tongass Avenue would result in increased noise levels that would effectively widen the impact area by 12 feet or less (i.e., as much as 6 feet on either side of centerline), as compared to the No Action Alternative (see Table 4-34). The greatest expansion of the noise threshold contour would occur in the northern end of the project area. Noise levels at the approaches to the intersections of the alternatives with Tongass Avenue and along the alternative alignments would be comparable to noise levels at other locations along Tongass Avenue. The relatively minor expansion of the noise impact area (i.e., no more than 6 feet on either side of centerline) as compared with the No Action Alternative, would have no effect on activities in the project area.

**TABLE 4-35
DISTANCE FROM CENTERLINE TO NOISE IMPACT THRESHOLDS
FOR ALTERNATIVES C3(a), C3(b), C4, AND D1**

Segment	PHV ¹ (2025)	Distance to Traffic Noise Impact Threshold (feet)	
		66 dB(A) ²	71 dB(A) ³
North Tongass Avenue to Bryant Street	2040	58	29
Bryant Street to Carlanna Lake Dr.	1990	57	28
Carlanna Lake Dr. to Third Ave.	2648	60	34
Third Ave. to Jefferson St.	2564	60	33
Jefferson St. to Washington St.	2386	57	32
Washington St. to Schoenbar Rd.	2469	58	32
Schoenbar Rd. to Dock St.	2422	56	27
Dock St. to Mission St.	1745	42	20
Mission St. to Main Street	1487	37	18
Main Street to Bawden Street	1182	34	16
Bawden Street to Deermount Street	1375	36	18
Deermount Street to South Tongass Highway	1249	33	16
Approach West of C3(a)/C3(b)/C4/D1	1808	48	25
Approach East of C3(a)/C3(b)/C4/D1	2050	53	27
New roadway alignment of C3(a)/C3(b)/C4/D1	330	39	19

¹ Peak Hourly Volume

² 66 dB(A) is 1 dB(A) less than the NAC for Activity Category B

³ 71 dB(A) is 1 dB(A) less than the NAC for Activity Category C

Alternative C3(a)

The closest noise sensitive receptor to Alternative C3(a) is a residence 70 feet from the centerline. The existing noise level in this residential neighborhood is 58 dB(A). The modeled future (2025) noise level at 70 feet from the centerline is 61 dB(A). Because the modeled noise level is less than 10 dB(A) higher than the existing noise level, and since the estimated distance to the residential traffic noise impact threshold along the new roadway alignment is 39 feet, and the closest residence is located approximately 70 feet away, it is unlikely Alternative C3(a) would have an impact on sensitive receptors along the new alignment.

Alternative C3(b)

The closest sensitive receptor to Alternative C3(b) is a residence 135 feet from centerline. The existing noise level in this residential neighborhood is 58 dB(A)⁶³. The modeled future (2025) noise level at 135 feet from the centerline is 55 dB(A). Because the modeled noise level is less than the existing noise level, and since the estimated distance to the residential traffic noise impact threshold along the new roadway alignment is 39 feet, and the closest residence is located approximately 135 feet away, it is unlikely Alternative C3(b) would have an impact on sensitive receptors along the new alignment.

Alternative C4

The closest sensitive receptor to Alternative C4 is a residence 65 feet from the centerline. The existing noise level in this residential neighborhood is 59 dB(A)⁶⁴. The modeled future (2025) noise level at 65 feet from the centerline is 62 dB(A). Because the modeled noise level is less than 10 dB(A) higher than the existing noise level, and since the estimated distance to the residential traffic noise impact threshold along the new roadway alignment is 39 feet, and the closest residence is located approximately 65 feet away, it is unlikely Alternative C4 would have an impact on sensitive receptors along the new alignment.

Alternative D1

The closest sensitive receptor to Alternative D1 is a residence 90 feet from the centerline. The existing noise level in this residential neighborhood is 59 dB(A)⁶⁵. The modeled future (2025) noise level at 90 feet from the centerline is 59 dB(A). Because the modeled noise level is the same as the existing noise level, and since the estimated distance to the residential traffic noise impact threshold along the new roadway alignment is 39 feet, and the closest residence is located approximately 90 feet away, it is unlikely Alternative D1 would have an impact on sensitive receptors along the new alignment.

4.26.7.3 Alternatives F1 (Preferred) and F3

As shown in Table 4-36, the distance from the centerline of Tongass Avenue to the most sensitive noise impact threshold ranges from 32 feet to 60 feet in the study area under Alternatives F1 and F3 during the peak hour of traffic volume. Noise levels would be greatest in the area between the north end of the study area and Dock Street. The increased traffic associated with these alternatives on Tongass Avenue would result in increased noise levels that would effectively widen the impact area by 10 feet or less (i.e., as much as 5 feet on either side of centerline), as compared to the No Action Alternative (see Table 4-34). The greatest expansion of the noise threshold contour would occur in the southern end of the project area, although traffic noise levels in that area would be lower than in the northern portion of the project area (i.e., north of Deermount Street). The relatively minor expansion of the noise impact area (i.e., no more than 5 feet on either side of centerline), as compared with the No Action Alternative, would have no noise impact in the project area.

⁶³ Ibid.

⁶⁴ Ibid.

⁶⁵ Ibid.

**TABLE 4-36
DISTANCE FROM CENTERLINE TO NOISE IMPACT THRESHOLDS
FOR ALTERNATIVES F1 AND F3**

Segment	PHV ¹ (2025)	Distance to Traffic Noise Impact Threshold (feet)	
		66 dB(A) ²	71 dB(A) ³
North Tongass Avenue to Bryant Street	1869	55	27
Bryant Street to Carlanna Lake Dr.	1874	55	27
Carlanna Lake Dr. to Third Ave.	2587	60	33
Third Ave. to Jefferson St.	2535	59	33
Jefferson St. to Washington St.	2413	57	32
Washington St. to Schoenbar Rd.	2521	59	33
Schoenbar Rd. to Dock St.	2502	57	28
Dock St. to Mission St.	1834	43	21
Mission St. to Main Street	1587	39	19
Main Street to Bawden Street	1302	34	17
Bawden Street to Deermount Street	1515	38	18
Deermount Street to South Tongass Highway	1422	37	18
Approach West of F1/F3	1492	36	18
Approach East of F1/F3	1256	32	16
New Roadway Alignment of F1/F3	420	46	23

¹ Peak Hourly Volume

² 66 dB(A) is 1 dB(A) less than the NAC for Activity Category B

³ 71 dB(A) is 1 dB(A) less than the NAC for Activity Category C

Alternative F1 (Preferred)

The closest sensitive receptor to Alternative F1 on Revillagigedo Island is a residence 275 feet from the centerline. The existing noise level in this residential neighborhood is 55 dB(A)⁶⁶. The modeled future (2025) noise level at 275 feet from the centerline is 50 dB(A). Because the modeled noise level is less than the existing noise level, and since the estimated distance to the residential traffic noise impact threshold is 46 feet, and the closest residence is located approximately 275 feet away, Alternative F1 would have no impact on sensitive receptors near the new alignment on Revillagigedo Island.

The closest sensitive receptors to Alternative F1 on Pennock and Gravina Islands are residences approximately 350 feet and 2300 feet from the centerline, respectively. The existing noise level at these receptors is 49 dB(A)⁶⁷. The modeled future (2025) noise level for the nearest sensitive receptor on Pennock Island is 47 dB(A) and 37 dB(A) for the nearest sensitive receptor on Gravina Island. Because the modeled noise levels are less than the existing noise levels, Alternative F1 would have no impact on sensitive receptors along the new alignment on Pennock and Gravina Islands.

⁶⁶ Ibid.

⁶⁷ Ibid.

Alternative F3

The closest sensitive receptor to Alternative F3 on Revillagigedo Island is a residence 200 feet from the centerline. The existing noise level in this residential neighborhood is 55 dB(A)⁶⁸. The modeled future (2025) noise level at 200 feet from the centerline is 53 dB(A). Because the modeled noise level is less than the existing noise level, and since the estimated distance to the residential traffic noise impact threshold is 46 feet, and the closest residence is located approximately 200 feet away, Alternative F3 would have no impact on sensitive receptors along the new alignment.

The closest sensitive receptors to Alternative F3 on Pennock and Gravina Islands are 1,000 feet and 1,500 feet from the centerline, respectively. The existing noise level at these receptors is 49 dB(A)⁶⁹. The modeled noise level for the nearest sensitive receptor on Pennock Island is 40 dB(A) and 39 dB(A) for the nearest sensitive receptor on Gravina Island. Because the modeled noise levels are less than the existing noise levels, Alternative F3 would not affect sensitive receptors along the new alignment on Pennock and Gravina Islands.

4.26.7.4 Alternative G2

As shown in Table 4-37, the distance from the centerline of Tongass Avenue to the most sensitive noise impact threshold ranges from 32 feet to 58 feet in the study area under Alternative G2 during the peak hour of traffic volume. Noise levels would be greatest in the area between Carlanna Lake Road and Dock Street. The increased traffic associated with this alternative on Tongass Avenue would result in increased noise levels that would effectively widen the impact area by no more than 2 feet (i.e., approximately 1 foot on either side of centerline), as compared to the No Action Alternative (see Table 4-34). Noise levels at the approaches to the intersection of the alternative with Tongass Avenue and along the alternative alignment would not be higher than noise levels at other locations in the study area. There are no sensitive receptors along the alignment; therefore, noise generated by traffic on Alternative G2 would have no impact on sensitive receptors.

⁶⁸ Ibid.

⁶⁹ Ibid.

**TABLE 4-37
DISTANCE FROM CENTERLINE TO
NOISE IMPACT THRESHOLDS FOR ALTERNATIVE G2**

Segment	PHV ¹ (2025)	Distance to Traffic Noise Impact Threshold (feet)	
		66 dB(A) ²	71 dB(A) ³
North Tongass Avenue to Ferry Terminal Access Drive	1721	52	26
Ferry Terminal Access Drive to Bryant Street	1827	54	27
Bryant Street to Carlanna Lake Dr.	1814	54	27
Carlanna Lake Dr. to Third Ave.	2486	58	32
Third Ave. to Jefferson St.	2434	58	32
Jefferson St. to Washington St.	2268	54	31
Washington St. to Schoenbar Rd.	2358	56	31
Schoenbar Rd. to Dock St.	2320	54	27
Dock St. to Mission St.	1646	40	20
Mission St. to Main Street	1392	36	18
Main Street to Bawden Street	1094	32	15
Bawden Street to Deermount Street	1294	36	17
Deermount Street to South Tongass Highway	1175	34	16
Approach West of G2	1654	46	23
Approach East of G2	1721	48	24
G2	101	7	3

¹ Peak Hourly Volume

² 66 dB(A) is 1 dB(A) less than the NAC for Activity Category B

³ 71 dB(A) is 1 dB(A) less than the NAC for Activity Category C

4.26.7.5 Alternative G3

As shown in Table 4-38, the distance from the centerline of Tongass Avenue to the most sensitive noise impact threshold ranges from 31 feet to 58 feet in the study area under Alternative G3 during the peak hour of traffic volume. Noise levels would be greatest in the area between Carlanna Lake Road and Dock Street. The increased traffic associated with this alternative on Tongass Avenue would result in increased noise levels that would effectively widen the impact area by no more than 2 feet (i.e., approximately 1 foot on either side of centerline), as compared to the No Action Alternative (see Table 4-34). There are no sensitive receptors along the alignment; therefore, noise generated by traffic on Alternative G3 would have no impact on sensitive receptors.

TABLE 4-38
DISTANCE FROM CENTERLINE
TO NOISE IMPACT THRESHOLDS FOR ALTERNATIVES G3

Segment	PHV ¹ (2025)	Distance to Traffic Noise Impact Threshold (feet)	
		66 dB(A) ²	71 dB(A) ³
North Tongass Avenue to Ferry Terminal Access Drive	1732	52	26
Ferry Terminal Access Drive to Bryant Street	1784	53	26
Bryant Street to Carlanna Lake Dr.	1794	53	26
Carlanna Lake Dr. to Third Ave.	2472	58	32
Third Ave. to Jefferson St.	2432	58	32
Jefferson St. to Washington St.	2305	55	31
Washington St. to Schoenbar Rd.	2359	56	31
Schoenbar Rd. to Dock St.	2321	54	27
Dock St. to Mission St.	1647	40	20
Mission St. to Main Street	1393	36	18
Main Street to Bawden Street	1095	31	15
Bawden Street to Deermount Street	1295	34	17
Deermount Street to South Tongass Highway	1175	32	16
G3	730	29	14

¹ Peak Hourly Volume

² 66 dB(A) is 1 dB(A) less than the NAC for Activity Category B

³ 71 dB(A) is 1 dB(A) less than the NAC for Activity Category C

4.26.7.6 Alternative G4

As shown in Table 4-39, the distance from the centerline of Tongass Avenue to the most sensitive noise impact threshold ranges from 32 feet to 58 feet in the study area under Alternative G4 during the peak hour of traffic volume. Noise levels would be greatest in the area between Carlanna Lake Road and Dock Street. The increased traffic associated with this alternative on Tongass Avenue would result in increased noise levels that would effectively widen the impact area by no more than 2 feet (i.e., approximately 1 foot on either side of centerline), as compared to the No Action Alternative (see Table 4-34). There are no sensitive receptors along the alignment; therefore, noise generated by traffic on Alternative G4 would have no impact on sensitive receptors.

TABLE 4-39
DISTANCE FROM CENTERLINE
TO NOISE IMPACT THRESHOLDS FOR ALTERNATIVES G4

Segment	PHV ¹ (2025)	Distance to Traffic Noise Impact Threshold (feet)	
		66 dB(A) ²	71 dB(A) ³
North Tongass Ave. to Ferry Terminal Access Drive	1775	53	26
Ferry Terminal Access Drive to Bryant Street	1845	55	27
Bryant Street to Carlanna Lake Dr.	1810	54	27
Carlanna Lake Dr. to Third Ave.	2482	58	32
Third Ave. to Jefferson St.	2429	58	32
Jefferson St. to Washington St.	2266	54	31
Washington St. to Schoenbar Rd.	2357	56	31
Schoenbar Rd. to Dock St.	2321	54	27
Dock St. to Mission St.	1647	40	20
Mission St. to Main Street.	1393	36	18
Main Street to Bawden Street	1095	32	15
Bawden Street to Deermount Street	1295	36	17
Deermount Street to South Tongass Avenue	1175	34	16
G4	202	13	6

¹ Peak Hourly Volume

² 66 dB(A) is 1 dB(A) less than the NAC for Activity Category B

³ 71 dB(A) is 1 dB(A) less than the NAC for Activity Category C

4.26.8 Water Quality Impacts

The secondary effects of project-induced development on water quality in both fresh water and marine environments are primarily caused by land-clearing activities that increase the potential for surface water runoff and erosion, which could lead to increased sedimentation in streams and near shore areas, as well as increased water turbidity (cloudiness). Runoff would also increase as a result of the increase in impervious area associated with new roadway facilities and structures. Increased human activity on Gravina Island could also increase the potential for pollutants (e.g., trash, petroleum products from cars, and household and industrial wastes) to enter streams. Industrial development along the shoreline would introduce a greater risk of pollutant releases to the marine environment.

4.26.8.1 No Action Alternative

The No Action Alternative could have adverse effects on water quality in the North Gravina area from residential development, which could occur adjacent to wetlands, small streams, and the marine environment of Tongass Narrows. Because development in this area would be relatively limited (15 acres) and would not involve the creation of extensive impervious surfaces, the impacts would be minor. Industrial use in the Central Gravina and Airport Reserve area could adversely affect the near-shore marine environment as a result of potential accidental industrial releases and an increase in impervious area, which would result in increased runoff.

4.26.8.2 Alternatives C3(a), C3(b), C4, D1, G2, G3, and G4

Under Alternatives C3(a), C3(b), C4, D1, G2, G3, and G4, adverse effects on water quality are anticipated on Gravina Island in the North Gravina and Vallenar Bay areas from residential

development, which could occur adjacent to wetlands, small streams, and the marine environment of Tongass Narrows. Industrial use in Central Gravina and Airport Reserve area could adversely affect water quality in the near-shore marine environment as a result of potential accidental industrial releases and an increase in impervious area, which would result in increased runoff.

Road access to USFS lands and Vallenar Bay would introduce potential impacts on water quality in the interior of Gravina Island as a result of increased human activity in these areas. Residential development at Vallenar Bay could adversely affect water quality in wetlands, small streams, and the marine environment of Vallenar Bay as a result of land-clearing activities and increased runoff and erosion.

4.26.8.3 Alternatives F1 (Preferred) and F3

Under Alternatives F1 and F3, adverse effects on water quality from residential development are anticipated on Pennock Island and on Gravina Island in the North Gravina and Clam Cove and Blank Inlet areas. Residential development in these areas could occur adjacent to wetlands, small streams, and the marine environment of Tongass Narrows. Human activity in these areas could adversely affect water quality. Industrial development and use in the Central Gravina and Airport Reserve area could have an adverse effect on water quality in the near-shore marine environment as a result of potential accidental industrial releases and an increase in impervious area, which would result in increased runoff.

Road access to USFS lands would introduce potential impacts on water quality in the interior of Gravina Island as a result of increased human activity in these areas. Road extension to and residential development at Blank Inlet could adversely affect water quality in small streams and the marine environment of Blank Inlet as a result of land clearing activities, increased runoff and erosion, and increased human activity.

4.26.9 Wetland and Vegetation Impacts

Development in the Ketchikan area inevitably results in loss of wetlands because so many of the lands where building is practical are wet. As wetlands are cleared and filled to provide foundations for roads, homes, and businesses, the functions of the wetlands are permanently lost. These functions include maintaining natural hydrologic regimes and moderating stream flows, producing plant material that supports on-site and off-site ecosystems, providing wildlife habitat and travel corridors, supporting fish habitat by providing stream cover and structure and food sources, and providing subsistence and recreational areas for humans. In addition, wetlands adjacent to development are affected by increased and polluted runoff, channelized runoff, and by the human activity that occurs within developed areas. Runoff from roads, yards, and gardens might carry with it nutrients (e.g., phosphorous and nitrogen) and sediments that alter the types of plants and animals that occupy the wetlands. Impervious surfaces created by building pads and roads result in increased runoff, which may alter remaining adjacent wetlands' and streams' hydrologic regimes and cause erosion. Human and pet activity degrades the quality of habitat on adjacent lands and displaces sensitive animals.

Development entails vegetation removal in uplands as well, which results in a loss of wildlife habitat and increased runoff and potential for erosion.

4.26.9.1 No Action Alternative

The No Action Alternative would have adverse effects on wetlands in the North Gravina and Central Gravina and Airport Reserve areas from industrial and residential development; almost all lands that would be developed are wetlands. Development in these areas would be relatively limited (20 acres total) in extent, so the offsite effects would not likely be substantial.

4.26.9.2 Alternatives C3(a), C3(b), C4, and D1

Under these alternatives, wetlands would be replaced by human developments on Gravina Island—in the North Gravina and Vallenar Bay areas by residential development and in the Central Gravina and Airport Reserve area by industrial and commercial development. Most of the 310 acres of anticipated development would occur in wetlands because relatively little upland exists in those areas. The adverse effects of the wetland loss and increase of human activity within wetlands are as described at the beginning of this section. Depending on where and how development would occur, it could have noticeable effects off-site.

4.26.9.3 Alternatives F1 (Preferred) and F3

Under Alternatives F1 and F3, adverse effects on wetlands are anticipated on Pennock Island and on Gravina Island in the North Gravina and Clam Cove and Blank Inlet areas from residential development. Almost all of the expected development—406 acres on Gravina Island and 76 acres on Pennock Island—would occur in wetlands because little upland exists there. The adverse effects of the wetland loss and increase of human activity within wetlands are as described at the beginning of this section. Depending on where and how development would occur, it could have noticeable effects off-site.

4.26.9.4 Alternatives G2 and G4

Under these alternatives, adverse effects on wetlands are anticipated on Gravina Island in the North Gravina and Vallenar Bay areas from residential development and in the Central Gravina and Airport Reserve area from industrial and commercial development. The 73 acres of anticipated development would mostly occur in wetlands because little upland exists in those areas. The adverse effects of the wetland loss and increase of human activity within wetlands are as described at the beginning of this section. Depending on how and where development would occur, it might have little noticeable effect off-site.

4.26.9.5 Alternative G3

Alternative G3 would have adverse effects on wetlands in the North Gravina area from residential development and in the Central Gravina and Airport Reserve area from residential, industrial and commercial development. Most of the 73 acres of anticipated development would occur in wetlands because little upland exists in those areas. The adverse effects of the wetland loss and increase of human activity within wetlands are as described at the beginning of this section. Depending on how and where development would occur, it might have little noticeable effect off-site.

4.26.10 Water Body Modification and Wildlife Impacts

4.26.10.1 Water Body Modification

Stream and wetland hydrology could be adversely affected by changes in the hydrologic regime as a result of increased sedimentation, increased impervious area, channelization, and soil compaction. The type, amount, and specific location of development relative to water bodies would dictate the magnitude of adverse secondary impacts on these resources. For all alternatives, modifications of water bodies could be avoided by selecting development sites that have no existing water bodies, and minimized by leaving buffers between development and water bodies and by limiting clearing and grading activities, which could change hydrologic regimes.

No Action Alternative

Projected development associated with the No Action Alternative would be relatively limited (20 acres) and would not involve the creation of extensive impervious surfaces.

Alternatives C3(a), C3(b), C4, and D1

Under these alternatives, modifications of water bodies could occur on Gravina Island in the North Gravina, Vallenar Bay, and Central Gravina and Airport Reserve areas from residential development (287 acres) and from industrial/commercial/community use (23 acres).

Alternatives F1 (Preferred) and F3

Under Alternatives F1 and F3, modifications of water bodies could occur on Pennock Island from access road and residential/community development (76 acres) and on Gravina Island in the North Gravina, Central Gravina and Airport Reserve, and Clam Cove and Blank Inlet areas from residential development (383 acres) and from industrial/commercial/ community use (23 acres).

Alternatives G2 and G4

Under these alternatives, modifications of water bodies could occur on Gravina Island in the North Gravina, Vallenar Bay, and Central Gravina and Airport Reserve areas from residential development (50 acres) and from industrial/commercial/community use (23 acres).

Alternative G3

Under Alternative G3, modifications of water bodies could occur on Gravina Island in the North Gravina and Central Gravina and Airport Reserve areas from residential development (50 acres) and from industrial/commercial/community use (23 acres).

4.26.10.2 Wildlife Impacts

Adverse secondary impacts on fish and wildlife would occur as a result of loss or disruption of habitat associated with development. Aquatic habitat would be adversely affected by in-water construction and development, and by activities that affect water quality. Increased human access might also increase risk of harassment of spawning salmon. Terrestrial species would be adversely affected by habitat losses associated with future development, as well as

increased human activity and noise that would disturb wildlife. Increased wildlife losses on Gravina Island are also expected to result from improved access for hunters.

No Action Alternative

Adverse secondary impacts of the No Action Alternative on fish and wildlife habitat would be limited to small areas of development and human activity that are primarily accessible by gravel road. Animals displaced by human activity could relocate to nearby similar habitat with negligible loss of life.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

The predominant habitat type potentially affected by development associated with the build alternatives would be wetlands, which could have a substantial effect on animals that use wetlands for feeding and shelter. With commercial and industrial development of the shoreline, animal use of the area would be reduced further.

Hunters, trappers, fishermen, and other recreationists would have increased access that would affect wildlife resources on Gravina Island and, in the case of Alternatives F1 and F3, on Pennock Island. Some animals would change their routes and foraging areas to avoid areas of increased human activity. Some animals, mainly bears and other scavengers, might be attracted to areas frequented by humans if people were to leave behind garbage and other attractants. The increase in human activity in the area could also lead to increased harvest or over harvest of certain species. Small populations, such as the wolf pack on Gravina Island, might be especially vulnerable to decline because of increased access from humans who kill wolves. Studies have shown that wolf abundance may be inversely correlated with road density.

Habitat fragmentation and barriers to wildlife movement would occur as a result of development of a road and the associated development activities. Possible adverse impacts could include the isolation of smaller, less mobile species; loss of genetic integrity within species or populations; and a decrease in usable ranges.

Alternatives C3(a), C3(b), C4, D1, G2, G3, and G4

These alternatives could have adverse secondary impacts on fish and wildlife habitat on Gravina Island. The development in the North Gravina and Vallenar Bay areas could reduce the amount and quality of important upland habitat and high-density deer wintering habitat.⁷⁰ There are also several streams classified as EFH north of the airport that could be affected by roadway, residential, and industrial development in that area. The combination of residential and industrial development in the North Gravina area would substantially alter animal activity in that area.

Development of a road to Vallenar Bay and residential development around Vallenar Bay would affect important upland habitat and could impact streams that provide EFH. Increased human activity in the area could affect animal use of the upland habitat and might alter animal migration patterns.

⁷⁰ Ketchikan Gateway Borough Department of Planning and Community Development, *Gravina Island Development Plan (Draft)*, January 2002.

Alternatives F1 (Preferred) and F3

Alternatives F1 and F3 could have adverse secondary impacts on fish and wildlife habitat on Pennock Island and on Gravina Island in the North Gravina, Central Gravina and Airport Reserve, and Clam Cove and Blank Inlet areas by reducing the amount and quality of important habitat and high-density deer wintering habitat.⁷¹ There are also several streams classified as EFH that could be affected by development in those areas, including Airport Creek, Government Creek, and Clam Cove Creek. The combination of residential and industrial development in the North Gravina and Central Gravina and Airport Reserve areas would substantially alter animal activity in those areas.

4.26.11 Floodplain Impacts

None of the project-induced development is expected to occur within floodplains. New development would likely be located above the 100-year flood elevation. No alteration to the hydraulic regime of floodplains is expected to occur as a result of any of the project alternatives; therefore, no adverse impacts to floodplains are expected.

4.26.12 Coastal Zone Impacts

Planning activity for *Ketchikan 2020*, which includes the Borough *Coastal Management Plan*, is being closely coordinated with the Gravina Access Project. Secondary impacts to resources within the coastal zone are expected to be consistent with the coastal management program.

4.26.13 Threatened or Endangered Species Impacts

4.26.13.1 No Action Alternative

Adverse secondary impacts on Steller sea lions and humpback whales as a result of the No Action Alternative are not expected because most development and human activity would be limited to small areas on land, primarily accessible by gravel road.

4.26.13.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

These alternatives could have adverse secondary impacts on Steller sea lions and humpback whales as a result of disturbance from man-made noise, increased development and access along shorelines, and pollution carried in runoff from development on land.

Increased development along the shoreline could alter sea lion and whale behavior as a result of increased use of Tongass Narrows by recreationists and industry. Increased public access might also increase the risk of harassment of marine mammals.

The aquatic environment is vulnerable to contamination from oil and fuel spills from vehicles and land-based and marine industry. Steller sea lions could become fatally ill from ingested oil, and suffer considerably from surface contact, especially by the eyes. Humpback whales would most likely not be affected by oil and fuel spills. However, contamination from oil and fuel spills could reduce humpback whale prey such as herring and krill; a spill could affect egg survival of these species and therefore reduce their abundance. The overall impact due to an oil spill is expected

⁷¹ Ibid.

to be minimal and the volume of oil or fuel that might be spilled at any given event would be relatively limited (see Appendix N).

4.26.14 Historic and Archeological Preservation

Secondary impacts on cultural resources would likely result from development of residential, commercial, or industrial properties along the shorelines of Gravina and Pennock Islands. Some development of this type is likely to occur regardless of the outcome of this project. Alternatives that increase accessibility to these shoreline areas may spur more rapid or larger developments, which in turn could affect historic and archaeological sites. In addition, improved public access to shoreline areas with cultural resources could result in destruction of these resources or their removal by shoreline visitors. In certain areas, not known at this time, it is possible that greater development could lead to better cataloging and preservation of cultural features.

4.26.14.1 No Action Alternative

Under the No Action Alternative, development along the Tongass Narrows shoreline of Gravina Island in the North Gravina area and the Central Gravina and Airport Reserve area has the potential to affect archaeological and historic properties in those areas. Because the amount of development in these areas would be approximately 20 acres and the access would be inconvenient, the potential effects on cultural resources would be relatively low.

4.26.14.2 Alternatives C3(a), C3(b), C4, and D1

Development along the shorelines of Gravina Island in the North Gravina, Central Gravina and Airport Reserve, and Vallenar Bay areas could result in the physical destruction of cultural properties from construction activities and from increased access that generates increased human activity. With about 300 acres of development projected by 2025, the secondary impact potential is greater than under the No Action Alternative. Little additional impact potential, beyond the No Action level, is anticipated on Pennock Island under these alternatives.

4.26.14.3 Alternatives F1 (Preferred) and F3

Development along the shorelines of North Gravina, Central Gravina and Airport Reserve, and Clam Cove and Blank Inlet areas, as well as on Pennock Island, could result in the physical destruction of cultural properties from construction activities and from increased access that generates increased human activity. With approximately 400 acres of development projected on Gravina Island and 75 acres on Pennock Island, the potential to affect cultural sites is greater than under the No Action Alternative. Early homesteading occurred north of the airport and in the vicinity of Clam Cove, indicating a likelihood of historic sites in those areas. Pennock Island was used as a burial site for tribal communities on Revillagigedo and Annette Islands in the late Nineteenth and early Twentieth Centuries. Disturbance of these sites would be of concern to the tribal communities and could affect their cultural practices.

4.26.14.4 Alternatives G2 and G4

Development along the shorelines of Gravina Island in the North Gravina and Central Gravina and Airport Reserve areas, and in the Vallenar Bay area, could result in the physical destruction of cultural properties from construction activities and from increased access that generates

increased human activity. Early homesteading occurred north of the airport, indicating a likelihood of historic sites in those areas. Because the amount of development projected is only 73 acres and the convenience of access would not be as improved as with a hard link, the potential impacts on cultural resources would be only slightly greater than with the No Action Alternative.

4.26.14.5 Alternative G3

The amount of secondary development projected for Alternative G3 is the same as Alternatives G2 and G4. The location of that development is centered somewhat farther south on Gravina Island in the North Gravina and Central Gravina and Airport Reserve areas but not in the Vallenar Bay area. Such development could result in the physical destruction of cultural properties from construction activities and from increased access that generates increased human activity. Early homesteading occurred north of the airport, indicating a likelihood of historic sites in those areas. Because the amount of development projected is only 73 acres and the convenience of access would not be as improved as with a hard link, the potential impacts on cultural resources would be only slightly greater than with the No Action Alternative.

4.26.15 Visual Impacts

4.26.15.1 No Action Alternative

Development on Gravina Island would be limited to 20 acres and would occur in areas that are not predominant in views from the populated areas of Revillagigedo Island (i.e., the North Gravina area and the Central Gravina and Airport Reserve area). Therefore, no visual impact is expected under the No Action Alternative.

4.26.15.2 Alternatives C3(a), C3(b), C4, and D1

Development of on Gravina Island could affect views from Revillagigedo Island; however, most of the development (i.e., 287 acres of the 310 total acres) would be residential and be located in the North Gravina and Vallenar Bay areas, which are not predominant in views from the populated areas of Revillagigedo Island. Also, the residential development would likely be small in scale and occur in isolation or small clusters, which would not create a noticeable change in the viewshed.

4.26.15.3 Alternatives F1 (Preferred) and F3

Development on Gravina Island could adversely affect views from Revillagigedo Island. Most of the development (i.e., 383 acres of the 406 total acres) would be residential and be located in the Clam Cove and Blank Inlet, Central Gravina and Airport Reserve, and North Gravina areas. Clam Cove and the Central Gravina and Airport Reserve areas are within the viewshed of populated areas of Revillagigedo Island. Because the residential development would likely be small in scale and occur in isolation or small clusters, it is not expected to create a noticeable change in the viewshed.

Development on Pennock Island under Alternatives F1 and F3 would be visible from downtown Ketchikan and Saxman because of the relative proximity of Pennock Island to these populated areas. Most of the development on Pennock Island would be residential and would occur along

the shoreline. The predominantly natural viewsheds from Downtown Ketchikan and Saxman would not be adversely altered.

4.26.15.4 Alternatives G2 and G4

Development on Gravina Island would be limited to 73 acres and would occur in areas that are not predominant in views from the populated areas of Revillagigedo Island (i.e., the North Gravina, Central Gravina and Airport Reserve, and Vallenar Bay areas). Most of the development (i.e., 50 acres) would be residential and be located in the North Gravina and Vallenar Bay areas, which are not predominant in views from the populated areas of Revillagigedo Island. Also, the residential development would likely be small in scale and occur in isolation or small clusters, which would not create a noticeable change in the viewshed. Therefore, no visual impact is expected under Alternatives G2 and G4.

4.26.15.5 Alternative G3

Development on Gravina Island would be limited to 73 acres and would occur in areas that are not predominant in views from the populated areas of Revillagigedo Island (i.e., the North Gravina area and the Central Gravina and Airport Reserve area). Most of the development (i.e., 50 acres) would be residential and be located in the North Gravina area, which is not predominant in views from the populated areas of Revillagigedo Island. Also, the residential development would likely be small in scale and occur in isolation or small clusters, which would not create a noticeable change in the viewshed. Therefore, no visual impact is expected under Alternative G3.

4.26.16 Energy Impacts

Although all of the project alternatives would result in additional growth in the Borough and generate more energy needs, it would not affect the ability of vendors to supply the required amount of energy. Secondary impacts on energy resources are not expected.

4.26.17 Utility Impacts

Future development on Gravina Island and, for Alternatives F1 and F3, Pennock Island would require provision of water, sewer, electric, and telephone facilities. The existing utility systems have adequate capacity to supply these utilities to development areas on Gravina and Pennock Islands under any of the alternatives. Impacts on the utilities would be minor, and related primarily to the construction and maintenance of new utility transmission line corridors.

4.26.17.1 No Action Alternative

It is unlikely that KPU would construct new water transmission lines and new water storage facilities on Gravina Island for the 20 acres of development expected to occur there under the No Action Alternative. Wastewater would likely be handled by “on-lot” disposal systems for low-density residential and industrial development, having no adverse effect on the utility system.

Electricity would likely be obtained by on-site generators, having no impact on the electrical utility system. Telephone connection for the new development is unlikely.

4.26.17.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

With the anticipated development on Gravina Island under these alternatives, new transmission lines would be needed to transport water to Gravina Island, and water storage facilities on the island would be needed to meet fire flow needs. These facilities would require additional land clearing, which could affect fish and wildlife habitat. The transmission line corridors would follow roadway corridors where practicable to reduce the amount of construction in pristine habitat. In areas where the transmission corridor would not follow the roadway, the transmission corridor would be maintained in low vegetation coverage. This would not preclude animal use of the transmission corridor, but would alter the habitat type. It is unlikely that the 76 acres of development on Pennock Island under Alternatives F1 and F3 would warrant construction of water distribution lines. Water supply on Pennock Island would likely continue to be obtained from cisterns on individual properties.

Although the existing wastewater treatment plant has the capacity to treat wastewater from Gravina and Pennock Islands under these alternatives, it might be more cost-effective to establish “on-lot” disposal systems for low-density residential development and, for core area developments of commercial and/or industrial facilities, a small “package” wastewater treatment plant and outfall. Such a system would be established within the requirements of the Clean Water Act to mitigate the potential adverse effects of discharge from the outfall.

The electrical system has sufficient capacity to support the additional development on Gravina and Pennock Islands under any of these alternatives; however, a new substation in Ketchikan and a substation on Gravina Island connected by a submarine line across Tongass Narrows would be required. Placement of the submarine line could have minor short-term impacts on marine habitat and water quality. The size and locations of the substations would be based on proximity to users and layout of the distribution system and would require land-clearing activities, which would affect terrestrial habitat. New transmission lines would be needed on Gravina and Pennock Islands, which would require additional clearing of wildlife habitat. The transmission line corridors would follow roadway corridors where practicable to reduce the amount of construction in pristine habitat. In areas where the transmission corridor would not follow the roadway, the transmission corridor would be maintained in low vegetation coverage, which would provide an alternate habitat type.

The connection to the existing telephone system on Revillagigedo Island from Gravina Island and Pennock Island would require a new (submarine) fiber optic cable across Tongass Narrows and a cable line system connecting to new areas of development. As in the case of other new utility lines, development of the telephone lines would require additional clearing of wildlife habitat. Where practicable, the telephone line corridors would follow roadway corridors to reduce the amount of construction in pristine habitat. In areas where the transmission corridor would not follow the roadway, the transmission corridor would be maintained in low vegetation coverage, which would provide an alternate habitat type. Placement of the submarine cable could have minor short-term impacts on marine habitat and water quality.

4.27 CUMULATIVE IMPACTS

The analysis of cumulative effects is centered on four key elements:

- ◆ Critical resources likely to experience cumulative effects

- ◆ The geographic (spatial) boundaries of the affected area
- ◆ The temporal (time frame) of the analysis
- ◆ The relevant past, present, and future actions that could affect the critical resources

The critical resources identified for the cumulative impact analysis are: land use, the recreation and subsistence elements of the social environment, local economic conditions, transportation, water quality, wetlands, wildlife, historic and archeological resources, and visual resources.

The geographic boundaries for evaluating potential cumulative effects were identified for each critical resource based on the distribution of the resource relative to the area in which significant cumulative effects could occur and beyond which the resource would not be substantially affected. For water quality, wetlands, wildlife, and historic and archeological resources, the geographic area comprises Gravina and Pennock Islands. For water quality, the area also includes Tongass Narrows and East and West Channels. For land use, the social environment, economics, transportation, and visual resources, the area is broader, encompassing the Borough and including the cities of Ketchikan and Saxman.

The temporal boundaries for determining cumulative impacts of the project were based on the rise in settlement and development in the area during the past 100 years and a planning horizon extending out to 2025. The Gold Rush of the early Twentieth Century brought about rapid growth and development of southeast Alaska, including Ketchikan. Growth in the timber industry in the area also contributed to development of Ketchikan. The relatively recent changes in the area due to exploitation of natural resources help establish the temporal boundary of past actions. The future temporal boundary of 2025 is considered as a reasonable horizon for community planning.

Each resource potentially affected by the project was individually examined to identify all past, present, and future activities and factors affecting that resource.

Past Actions. For purposes of this analysis, past actions are:

- ◆ Logging
- ◆ Mining
- ◆ Hunting, fishing, and trapping
- ◆ Industrial, commercial, and residential development

Future Actions. Reasonably foreseeable future projects are:

- ◆ Improvements associated with the Ketchikan International Airport Master Plan⁷² (i.e., parking additions, circulation modifications, and expansions of the terminal, apron, and taxiway)
- ◆ Activities associated with the preferred alternative presented in the Gravina Island Timber Sale Draft Environmental Impact Statement⁷³

⁷² DOT&PF. *Ketchikan International Airport Master Plan Draft Final Report*. November 2002.

⁷³ USFS, *Gravina Island Timber Sale Draft Environmental Impact Statement*, December 2002.

- ◆ A proposed gravel road between the airport and the Pacific Log and Lumber timber processing facility north of the airport that follows the south and west boundaries of the airport and extends north of the airport to Lewis Reef. The road would be limited in width, but would provide public access to Borough and private land adjacent to and immediately north of the airport. The planned access would be on a road from the ferry landing that follows the south and west boundaries of the airport.

These above-listed future actions have been identified by the Borough Planning Department as actions that are likely to occur, independent of the Gravina Access Project. The road between the airport and the Pacific Log and Lumber timber processing facility north of the airport, approximately 3.9 miles long, would be in approximately the same location as the airport access road and spine road common to all alternatives of the Gravina Access Project. The Borough has acquired a provisional permit from the COE for construction of this road; however, at this time, funding has not been secured for construction of the road. The DOT&PF would closely coordinate the location and design of the airport access road and spine road with this gravel road to minimize additional clearing of right-of-way.

Although it is possible that, in the case of Alternatives F1 and F3, a road would be constructed on Pennock Island to provide a connection between the project roadway and homes on the island, the Borough has no plan for infrastructure on Pennock Island independent of the Gravina Access Project. Therefore, new road construction on Pennock Island is not considered a reasonably foreseeable future action in this cumulative impact analysis. It is, however included in the cumulative impact analysis of Alternatives F1 and F3 because it is a likely indirect (secondary) action associated with those alternatives.

The cumulative impact assessment considered the direct and indirect (secondary) impacts of the Gravina Access Project alternatives together with the impacts of past, present, and reasonably foreseeable future actions on the critical resources within the appropriate geographic and temporal boundaries.

4.27.1 Land Use Impacts

The Borough Department of Planning and Community Development has been reviewing the existing land uses and planning for future growth and development on Gravina Island. The goal of the Borough is to assist the Ketchikan community in making decisions regarding future development of Gravina Island. This planning activity is being conducted in conjunction with the Gravina Access Project, as well as with the other reasonably foreseeable future projects. Including all of these projects in the planning process ensures consistency in land use goals and development trends. Because of this coordinated planning activity, the Gravina Access Project, considered with the reasonable foreseeable actions, would have no adverse cumulative effect on the land use plans, policies, and goals of the Borough.

On Gravina Island, the cumulative effects of past, present, the proposed, and reasonably foreseeable future actions on land use would be the gradual change from undeveloped land to developed land along the eastern shorelines of the island, which would occur under the No Action Alternative and all of the build alternatives. With most of the land owned by the U.S. Forest Service and the Alaska Department of Natural Resources, it is likely that most of the island would be maintained as undeveloped lands. Therefore, the physical changes in overall land use on Gravina Island would be very small.

On Pennock Island, there is no reasonably foreseeable action other than the Gravina Access Project that would contribute to land use changes; therefore, no cumulative impacts on land use on Pennock Island are expected.

4.27.2 Social Impacts

There are two elements comprising the social environment that would experience cumulative impacts as a result of the project alternatives: recreation and subsistence on Gravina and Pennock Islands. Recreational and subsistence uses of natural resources on Gravina and Pennock Islands have been limited because access is possible only by private boat or floatplane and, for Gravina Island, the airport ferry, and that access is provided only to the shorelines. Once on the shoreline of either island, access to the interior and most other areas of these islands is limited to foot traffic. Past use of subsistence resources has increased steadily with population growth in the area. The No Action Alternative would not contribute to any change in recreation or subsistence uses of Gravina or Pennock Islands.

4.27.2.1 Alternatives C3(a), C3(b), C4, and D1

The cumulative effect of improved road access to Gravina Island on recreation would be the attraction of more tourists and visitors to the area. People who drive for recreational pleasure would be able to access the once-remote interior areas of Gravina Island. The USFS plans to enhance recreation resources in the area by creating trails and campgrounds and possibly cabins for recreational use. Increased recreational opportunities on Gravina Island would enhance overall recreation resources in the Ketchikan area.

The primitive setting within the interior of the island would be modified by the road system and the increase in human activity, which might deter people seeking a primitive experience.

Residents of Ketchikan, Metlakatla, and Saxman use Gravina Island and its surrounding waters for subsistence resources. With greater accessibility to Gravina Island, more residents would be using its subsistence resources, and competition for these resources would increase. Much of this increased competition for subsistence use of resources on Gravina Island, however, would probably result from a shifting of subsistence harvesting from elsewhere in the Borough to Gravina Island, rather than representing an overall net expansion of these activities. Even with the increased competition on Gravina Island, most subsistence resources there would be sustainable, with enough resources for everyone. However, increased competition for subsistence hunting of deer could decrease the deer population to a level that is not sustainable. This impact could be compounded by another project impact, a loss of deer habitat (see Section 4.15.7). As a result, subsistence use of deer could be substantially restricted.

4.27.2.2 Alternatives F1 (Preferred) and F3

Alternatives F1 and F3 would have the same benefits and adverse impacts as those described for Alternatives C3(a), C3(b), C4, and D1. In addition, either Alternative F1 or F3 could contribute substantially to growth in recreational and subsistence uses of Pennock Island by improving access to the area. However, because there are no reasonably foreseeable future actions on Pennock Island, the cumulative beneficial effects on recreation and subsistence resources there are expected to be negligible.

4.27.2.3 Alternatives G2, G3, and G4

Without hard-link access (such as a bridge) to Gravina or Pennock Island, growth in recreational and subsistence uses of Gravina Island would be associated primarily with the preferred alternative of the Gravina Island Timber Sale EIS. Although, access would be improved with a new ferry, there would be no significant cumulative effects on recreational and subsistence uses of Gravina or Pennock Islands as a result of the ferry alternatives.

4.27.3 Economic Impacts

Ketchikan and the surrounding area has grown in population and economic activity since late in the 19th Century as a fishing, timber, and tourist area and before that as a fishing area for Alaska Natives. The most pertinent past actions have been development of a timber and pulp industry and fishing industry around which Ketchikan grew to be the 5th third-largest city in Alaska in 2000. Tourism has boomed in southeast Alaska in the past two decades, primarily with steadily expanding cruise ship activity. Economic changes within the pulp and timber industry, coupled with management changes within Tongass National Forest, led to the closure of the Ketchikan pulp mill, a major Ketchikan employer. The resulting downturn in the Borough economy has been a catalyst for the current project, in an effort to diversify the economy and spur new growth.

The preferred alternative for the proposed USFS timber sale on Gravina Island and the Borough's proposed road between the airport and the sawmill site located north of the airport are reasonably foreseeable actions that would result in cumulative impacts on the regional economy. The timber sale preferred alternative would create 22.6 miles of new road, 15 miles of which would be left open for public access following the harvest activities.⁷⁴ The Forest Service road network would connect with the road proposed by the Borough to connect the airport and the sawmill site. If a build alternative for the Gravina Access Project were selected and the construction for these foreseeable actions were to occur at the same time as the construction activity for the Gravina Access Project, there may be insufficient local labor available for the number and type of jobs that would be created with all of the construction activity. This situation could require in-migration of workers from outside the region. If the in-migration occurs during the summer months when services and facilities in Ketchikan are stretched by the seasonal influx of tourists and visitors, the additional in-migration could be an adverse impact.

With improved access to Gravina Island and the additional road network established as part of the USFS Gravina Island timber sale preferred alternative, transporting timber to processing facilities could be enhanced, which could spur growth in the logging industry. Such growth would be limited by the viability of trucking substantial quantities of timber to Tongass Narrows and Revillagigedo Island and by restrictions on the amount of logging that can be done in the area, as per USFS resource management plans for Tongass National Forest.

Other cumulative effects of the build alternatives on the Ketchikan economy are described below; the No Action Alternative would have no cumulative effect on the economy of Ketchikan.

⁷⁴ USFS, *Gravina Island Timber Sale Draft Environmental Impact Statement*, January 2001.

4.27.3.1 Alternatives C3(a), C4, F1 (Preferred), G2, G3, and G4

The preferred timber sale alternative is projected to create a total of 346 direct and indirect jobs from the construction and harvesting activities.⁷⁵ Other jobs would be created by the construction of the proposed road and airport improvements. These jobs are in addition to those associated with the Gravina Access Project alternatives. The jobs associated with these foreseeable actions would reduce the unemployment rate and contribute income to a Ketchikan economy that is currently in a depressed situation. The availability of timber from Gravina Island that can be accessed via a road network would likely improve the financial position of the sawmill with the potential for additional employment as well. Expenditures by non-local construction workers would be a benefit to the local community.

4.27.3.2 Alternatives C3(b), D1, and F3

Construction of these alternatives would create jobs in addition to the 346 direct and indirect jobs associated with the preferred timber sale alternative, the proposed road, and airport improvements. The jobs associated with these foreseeable actions would reduce the unemployment rate and contribute income to a Ketchikan economy that is currently in a depressed situation. The availability of timber from Gravina Island that can be accessed via a road network would likely improve the financial position of the sawmill with the potential for additional employment as well. Expenditures by non-local construction workers would be a benefit to the local community.

Alternatives C3(b), D1, and F3 would reduce the amount of spending in Ketchikan by cruise ships, cruise passengers, and crew. The employment and income generated by the other reasonably foreseeable actions would offset some of the potential reduction in cruise-related spending during the period of construction and timber harvesting and processing activity.

4.27.4 Transportation Impacts

4.27.4.1 Aviation

No cumulative impacts on aviation are expected as a result of the Gravina Access Project. Implementation of the Airport Master Plan would be closely coordinated with the selected alternative of the Gravina Access Project. No other reasonably foreseeable action would affect aviation.

4.27.4.2 Vehicles

No Action Alternative

The cumulative impacts associated with the No Action Alternative relate to the inconvenience associated with continued reliance on the airport ferry for access to the airport and other lands on Gravina Island (via the gravel road proposed by the Borough), which would limit the amount of development on Gravina Island. Traffic to Gravina Island generated by the No Action Alternative may not be enough to warrant construction of additional parking facilities at the airport, as identified in the Airport Master Plan.

⁷⁵ Ibid.

Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

The cumulative impacts of the project build alternatives, when combined with the reasonably foreseeable future actions, would be the creation of a large road network that makes most of Gravina Island accessible. No adverse cumulative impact on transportation would occur. While an extensive roadway network would enhance vehicular transportation, it would have adverse effects on the environment (as described elsewhere in this section). The roadway on Gravina Island skirting the airport boundary to the south and west would be closely coordinated with the Borough's permitted gravel road so that clearing of new right-of-way would be minimized.

4.27.5 Pedestrian and Bicyclist Impacts

There would be no cumulative effects on pedestrians and bicyclists as a result of the No Action Alternative. With a greater network of roads on Gravina Island and improved access to Gravina Island under a build alternative, pedestrians and bicyclists would have more opportunities to walk and ride.

4.27.6 Geology and Soils Impacts

4.27.6.1 There would be no cumulative effects on geology and soils as a result of the No Action Alternative.

Permanent changes to topography and removal of soils to accommodate development of a build alternative combined with other past, present, and future development results in overall changes to land resources. The cumulative effect on these resources would not detract from the overall prevalence of natural landforms in the project area.

4.27.7 Water Quality Impacts

Water resources potentially adversely affected by the project, both directly and indirectly, are Tongass Narrows and several streams and water bodies on Gravina Island (Airport Creek, Government Creek, Clam Cove, Vallenar Bay and its tributaries, and Blank Inlet and its tributaries).

The major past and ongoing activities affecting water quality in Tongass Narrows are emission from boats and ships, discharges from seafood processing plants (permitted under NPDES), logging and timber processing, and discharge from cruise ships. Although these activities can degrade water quality, the strong tidal currents help flush pollutants out of Tongass Narrows and maintain its overall good water quality. Logging and mining activities may have affected the freshwater streams and marine waters of Gravina Island in the past; however, these water bodies at present have no known water quality problems.

Land-clearing and grading for the improvements to the airport, the Gravina Island timber sale, and the road north of the airport could have short-term adverse impacts on water quality during construction (from exposing sediments and debris to erosion), as well as long-term adverse impacts (from runoff and a larger impermeable area). The roads included in the timber sale project would also improve access to the interior of Gravina Island, which would result in increased human activity—and the potential for pollutants—near streams and lakes.

4.27.7.1 No Action Alternative

Secondary impacts on water quality on Gravina Island as a result of the No Action Alternative would contribute to the cumulative adverse effects of past and future actions on water resources. However, with no hard-link access to Gravina Island, the incremental impact would be negligible.

4.27.7.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

The build alternatives of the Gravina Access Project would contribute a slight incremental adverse impact on the water quality of Tongass Narrows and streams throughout Gravina Island when considered with all past, present, and reasonably foreseeable actions that have affected or could affect water quality. Pollutant sources associated with foreseeable development include untreated runoff from bridges, ferry emissions, roadway runoff, runoff and pollutant spills associated with industrial (including timber) and commercial development, runoff and pollutants produced by residential development, erosion resulting from land clearing and altered stream hydrology, and increased human activity on currently inaccessible lands.

4.27.8 Wetland Impacts

Wetlands on Gravina Island were lost during the period in which the Ketchikan International Airport was being developed. Most development on Gravina Island has been small in scale, having relatively little effect on wetlands; however, some wetlands were no doubt filled to construct the airport and the timber processing plant north of the airport. Continued growth in the region under any of the Gravina Access Project alternatives would require the filling of wetlands.

4.27.8.1 No Action Alternative

Secondary impacts on wetlands on Gravina Island as a result of the No Action Alternative would contribute to the cumulative effects of past and future actions on wetland resources. However, with no hard-link access to Gravina Island, the incremental impact would be negligible.

4.27.8.2 Alternatives C3(a), C3 (b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

The roadway development associated with the bridge and ferry alternatives of the Gravina Access Project, when considered with all past, present, and reasonably foreseeable actions, would have a cumulative effect on wetlands. Continued loss of wetland resources to development would reduce the function provided by these resources, including provision of wildlife habitat and moderation of surface runoff. The loss of wetland functions would be minor within the context of the Gravina and Pennock Island ecosystems and their extensive wetland resources. However, within specific watersheds (e.g., Government Creek and Airport Creek), a greater proportion of wetlands would be lost relative to the total wetland acreage in the watershed.

4.27.9 Water Body Modification and Wildlife Impacts

4.27.9.1 Water Body Modification

There has likely been little modification of water bodies to date on Gravina and Pennock Islands. Airport development has occurred between two major streams, with most of the water-related impacts of the airport affecting Tongass Narrows directly. The Gravina shoreline has been much altered by fill and rock-armoring related to airport and neighboring marine transport

development. The No Action Alternative would not contribute to cumulative impacts on water bodies.

The Gravina Access Project build alternatives, when considered with past, present, and other future actions, would contribute to the trend of modifying the Gravina waterfront along the airport and would induce development that could have a measurable cumulative effect on streams. Roadways, and clearing and filling for residential, commercial, and resource (timber) development would lead to direction of small streams into culverts, channelization of flows, and increased runoff intensity that could alter natural stream hydrology.

4.27.9.2 Wildlife Impacts

Fish and wildlife resources on Gravina and Pennock Islands have been affected by historic development of the shoreline, past logging activities, airport development, and hunting. These human activities have reduced habitat availability and quality, and affected the populations of some species. The No Action Alternative would not contribute to cumulative impacts on wildlife.

The Gravina Access Project alternatives, when considered with past, present, and other future actions, would add to existing cumulative effects on fish and wildlife species. Existing development, coupled with future actions (improvements to the airport, the Gravina Island timber sale, the road north of the airport, and widely dispersed residential and commercial development) would further impact fish and wildlife species and habitat on Gravina Island and Pennock Islands as a result of direct disturbance during construction and long-term use of the lands. Particularly important would be the improved access to and increased human activity in the interior of Gravina Island. The combination of improved access from the Gravina Access Project and new roads established for the Gravina Island timber sale and residential and commercial development would result in increased human activity in the interior of Gravina Island. This would potentially affect EFH associated with tributaries to Vallenar Bay and Bostwick Inlet, deer winter habitat around Bostwick Inlet, important upland habitats in the valley of Vallenar and Bostwick Creeks, and important marine habitat at Vallenar Bay and Bostwick Inlet. The Alexander Archipelago wolf is particularly sensitive to human presence and could experience declines in population as a result of increased human activity in these areas of Gravina Island. Roads may increase both legal harvest and illegal poaching of wolves. Increased human presence along the project corridor would also increase the frequency of bear-human interactions, some resulting in “defense of life and property” kills.

Hunters in Southeast Alaska actively pursue wolf and deer. With improved access to their habitat, it is likely that human harvest of these species would increase. It should be noted that, due to projected increases in numbers of hunters, even without improved access to Gravina Island or new roads associated with the USFS timber sale, future hunter demand for deer would reduce deer numbers. Because deer are the primary food source for wolves, an increase in deer harvest would reduce deer numbers, potentially to levels inadequate to support the wolf population, adding to its decline. The Alexander Archipelago wolves are dependent on long-term deer habitat viability. The loss of long-term carrying capacity for deer due to increased hunting and habitat degradation would be detrimental to wolf population viability. Regardless of alternative, increased hunting pressure and reduction of habitat viability could lead to a reduction in population viability of both wolves and deer on Gravina Island.

4.27.10 Historic and Archaeological Resources

Historically, the use and development of Gravina and Pennock Islands have occurred primarily along their shorelines, and have contributed to their cultural richness. Some development within the past 50 years, including the development of Ketchikan International Airport, could have resulted in the removal and/or destruction of cultural properties; however, documentation of such losses is limited.

Continued growth along the shorelines is anticipated under all of the alternatives evaluated for the Gravina Access Project, and this growth could have secondary impacts on cultural resources, as described in Section 4.26.14. Future actions associated with the Airport Master Plan would occur in areas that have been previously disturbed, and so would likely have no effect on cultural resources. Construction and long-term use of the proposed roads identified in the preferred alternative of the Gravina Island Timber Sale Draft EIS would have no effect on cultural resources (p. 3-27). Similarly, the proposed road north of the airport is expected to have no effect on cultural resources.

When considering past actions that could have resulted in adverse impacts on cultural resources with the project's secondary impacts and the impacts on cultural resources expected from reasonably foreseeable actions, cumulative impacts on cultural resources are not expected.

4.27.11 Visual Impacts

The incremental changes to the visual environment of the Ketchikan area throughout its history have been primarily related to human development along the western shoreline of Revillagigedo Island, the eastern shoreline of Gravina Island, and the northern shoreline of Pennock Island. The most significant adverse effects on the visual environment occurred through the development of commercial and industrial facilities along the shoreline of Revillagigedo Island and the development of the airport and related facilities on Gravina Island. All of these facilities introduced large-scale, man-made features into a predominantly natural viewshed. Logging activities on Gravina Island have historically been limited in scale, resulting in minor adverse impacts on visual resources. Similarly, mining activities have been limited and generally occurred in areas outside of the viewshed of most populated areas. The No Action Alternative would have no adverse cumulative effect on the visual environment.

4.27.11.1 Alternatives C3(a), C3(b), C4, and D1

The proposed development of any of the bridge alternatives near the airport (i.e., Alternatives C3(a), C3(b), C4, or D1) would contribute substantially to the influence of man-made structures on the viewshed in that area. With future development planned for the airport area (e.g., parking garage and runway extension), the elements contributing to the adverse cumulative impact on the visual environment would be concentrated in this section of Ketchikan. No other reasonably foreseeable actions would contribute significantly to the visual impacts near the airport. Any of these bridges would dominate views from marine vessels and aircraft in the area, particularly for vessels and aircraft transiting under or over the bridge.

4.27.11.2 Alternatives F1 (Preferred) and F3

The Alternative F1 or F3 bridges would be visible from downtown Ketchikan but, because it is 1.5 miles distant from major viewpoints in Ketchikan, the visual intrusion of the structures would

be limited. Alternative F1 would have a greater influence on the views from downtown Ketchikan than Alternative F3 because of the greater height of its East Channel bridge. Future development associated with the airport would affect the visual environment in that area. No past or reasonably foreseeable future actions in the area have contributed or would contribute substantially to the visual impacts of these alternatives. The adverse cumulative effect on visual resources would be the incremental increase in man-made structures in predominantly natural viewsheds.

4.27.11.3 Ferry Alternatives (G2, G3, and G4)

The ferry alternatives (G2, G3, and G4) would have a low profile within any of the viewsheds to which they contribute. When considered with past or reasonably foreseeable future actions in the area, the adverse cumulative impacts of these alternatives on the visual environment would be negligible.

4.28 SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

In the assessment of environmental impacts under NEPA, the natural productivity of land is viewed as a long-term, renewable resource, whereas a developed use of the land is considered a short-term use with a relatively short economic life. Therefore, conversion of the land use from its natural productivity to a developed use is an environmental impact.

4.28.1 No Action Alternative

Under the No Action Alternative, some of the productive land (wetlands and uplands) proposed for right-of-way under the build alternatives would be developed to some extent, as projected by the various land use and planning documents of the Borough. However, these short-term uses of the environment are consistent with local land use plans, and there is an abundant supply of naturally productive land in the area. Therefore, there would be no adverse effect on the long-term productivity of the renewable resources that dominate the area.

4.28.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

For the Gravina Access Project, the long-term productivity that would be lost is the current productivity of wetlands and forested uplands within the proposed right-of-way of the build alternatives. This natural productivity would be replaced by the relative short-term use of the land for the life of the proposed project. These losses are similar to, but of greater magnitude than, those that would occur under the No Action Alternative.

However, these short-term uses of the environment by the Gravina Access Project would be consistent with local land use plans, which are the same for the build alternatives and the No Action Alternative. In this context, there is little difference between the project alternatives.

Considering the overall abundance of naturally productive land in the project area, the project's consistency with local land use plans, and the benefits of the project's short-term use of the land, the project would not be detrimental to maintaining and enhancing the long-term productivity of the renewable resources that dominate the project area.

4.29 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

4.29.1 No Action Alternative

This alternative would involve no construction, and therefore would not irreversibly or irretrievably commit resources.

4.29.2 Alternatives C3(a), C3(b), C4, D1, F1 (Preferred), F3, G2, G3, and G4

The build alternatives would irreversibly and irretrievably commit a broad range of natural, physical, human, and financial resources. All of the build alternatives would adversely affect habitat and vegetation. Although mitigation measures would be implemented during project construction, re-creation or restoration of some of these areas would not be possible.

A substantial amount of cement, aggregate, and fill materials would be expended; although some fill material would come from established borrow pits. Significant amounts of human labor and physical resources would be used to fabricate and prepare construction materials, and these materials are generally not retrievable. However, these resources are not in short supply, and their use would not have an adverse effect upon their continued availability; construction is not predicted to exhaust known sources of these materials. The benefit provided by the project—improved access to Gravina Island—would outweigh the impacts of this commitment of resources.

The build alternatives would require a substantial expenditure of funds, which would not be retrievable. Federal funds (91 percent) and state funds (9 percent) would be expended to develop one of the build alternatives. The ferry alternatives would require the least commitment of financial resources: project development costs would range from approximately \$60 million (Alternative G4) to \$65 million (Alternatives G2 and G3). The Pennock Island alternatives would require the greatest commitment of financial resources: \$210 million (Alternative F3) to \$235 million (Alternative F1) in project development costs. The Pennock Island alternatives would also require the greatest commitment of environmental resources, with 7 to 8 miles of new roadway and over 100 acres of habitat losses. Alternatives C3(a), C3(b), C4, D1, G2, G3, and G4 would require 3 to 4 miles of new roadway and result in 40 to 60 acres of habitat losses.